

# Revolutionary Tennis

Tennis That Makes Sense



## Step 1

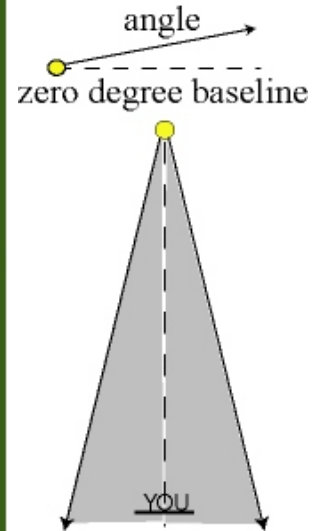
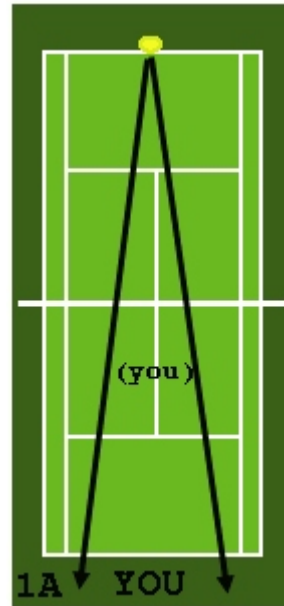
### The Geometric Reality of Tennis

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**Movement.** The first step in establishing a strong foundation with the body is by facing the undeniable truth about this game. A tennis player faces an angle of possibilities, which means the ball angles, or moves, away from you either to your right or to your left (1A). The ball is not hit at you. (The court is drawn to scale.)

The ball is moving away from you, and while there are different directions to intercept it, you want to hit the ball with some power and send it back where it came from, you simply don't want to run over and touch it or just stop it.

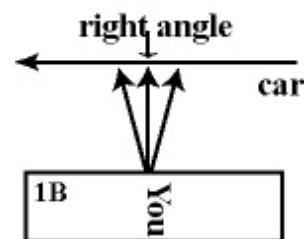


You've heard often enough that moving into the ball gives you power, that is getting your body's momentum behind the stroke and into the ball equals power. Why doesn't that happen often enough for you? Because if you either move parallel to the baseline, turn sideways, or pivot one foot to the side, you're moving away from the ball and not into it. It's simple geometry.

To see this, imagine you're ready to throw a tennis ball at a friend's car going past you parallel to the sidewalk on which you're standing (1B). If you throw the ball before the car is at a right angle to your position, you're throwing the ball INTO the car and it hits with force. If you throw after the car passes the right angle mark, the ball's moving AWAY with the car and catches up with it later, hitting with less impact.

### INTO THE BALL

Let's apply this to tennis. You're in the ready position behind the baseline and a ball is hit to your left side (1C). Draw a line from your position to form a right angle to the ball's flight line. If your movement pattern takes you to the inside of that right angle mark, that is in the direction of the net, you're moving forward and INTO the ball. And your ever so important momentum is going into the ball, which means power.



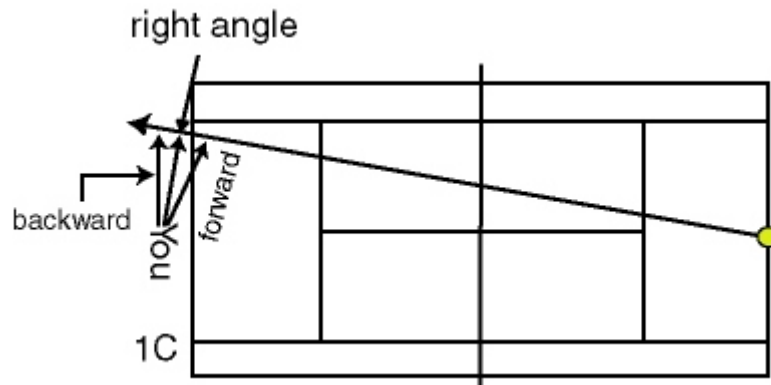
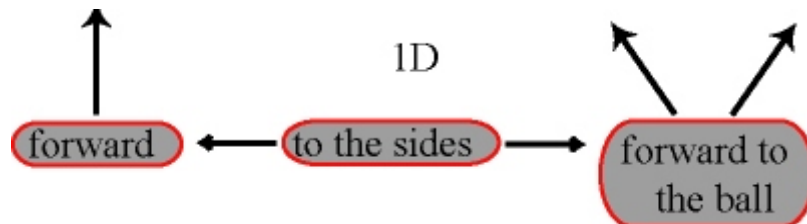


Diagram 1C shows that by moving parallel to the baseline you're moving away with the ball, catching up to it later. As a result your momentum is going off toward the side fence and not into the ball, it takes more time to reach it, and there's little chance your body can structure itself to support your contact spot because the ball has passed you by.

I know you feel you don't have enough time in which to hit the ball, but you can't give yourself more time to hit it by taking more time to reach it because the ball is angling away from you and getting lower.

## DIRECTIONS

In what direction lies forward? To one side? Into the ball? Diagram 1D explains. You want to move into the ball, you want your momentum into the ball.

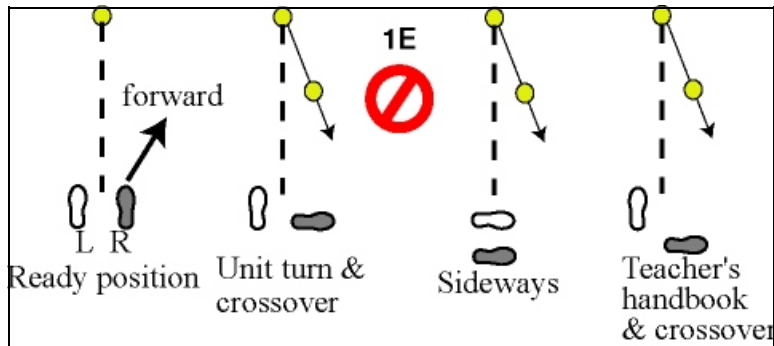
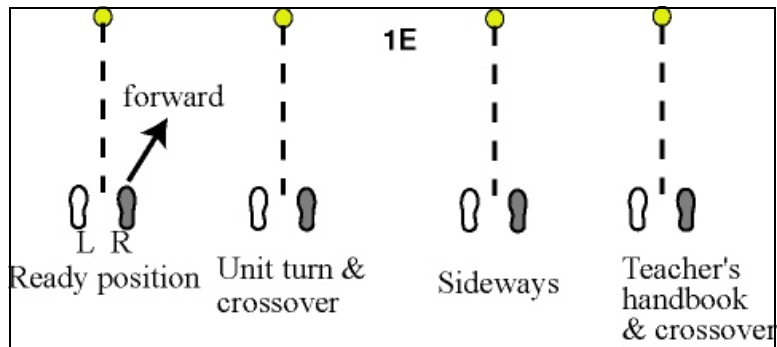


The angle of your movement relative to the ball's flight line helps you reach the ball on time, Step 2, structure the body for a strong hit, Step 3, and helps you develop power in a simple manner and not in one you're used to that is counterproductive to success, Step 4.

With your ready position three to five feet behind the baseline, moving into the ball means just that, moving forward. Not at full speed, simply not away from the ball, not parallel to the baseline or backwards. But this idea of moving forward won't happen if you first pivot one foot against the ground, turn sideways, or step backwards as diagram 1E shows because, undeniably, the ball's moving away from you. Less is more.

It's clear you need to move forward, into the ball, and not waste time or opportunity by pivoting against the ground or turning sideways. How should the feet move to achieve this? Which one first? Step 2 explains.





## OLD THINK

- pivot
- turn sideways
- step backwards
- move parallel to the baseline or over to the side

## NEW THINK

- move forward INTO the ball

# Revolutionary Tennis

Tennis That Makes Sense

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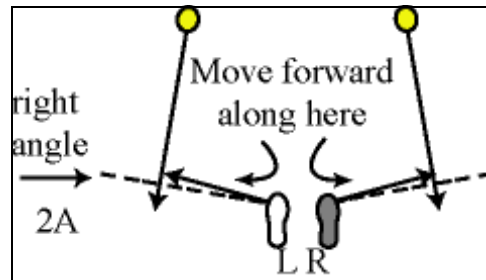
## Step 2

### How The Feet Work

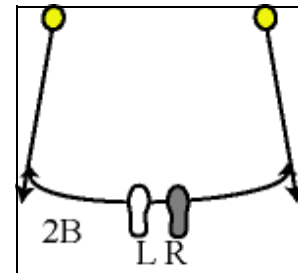
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Footwork. Step 1 shows that moving into a ball angling away from you means moving forward on an angle less than 90 degrees to the ball's flight line (2A). You don't move literally on a straight line as indicated in diagram 2A, but the idea is not to move beyond the 90 degree mark. Basically, the movement pattern is an arc (2B).



How should the feet move, which one first? There are different ways and directions in which to move the feet, but two things come to mind. First, you start by standing still at point A, the ready position, and will move forward to the contact spot at point B without compulsory steps, restrictions, or avoiding obstacles on the court.



Second, human beings are bipedal. That means human locomotion, our gait, works in two's, in pairs.

Child development literature explains the progression of motor skills involved when learning how to kick a soccer ball. First, a child stands still and swings 1 foot to kick the ball. Some time later, the child takes 1 step and kicks. This skill is considered fully developed when the child takes 2 steps and kicks the ball. This 2-step method prior to execution forms the basis of natural human rhythm.

## RHYTHM

If you're familiar with other sports that involve movement, such as basketball, soccer, or when fielding a baseball, you know you take a minimum of 2 steps before shooting, kicking, or throwing the ball. No matter how many steps are taken in the approach, the feet do a final 1-2 before executing the act: 1-2 throw, 1-2 shoot, 1-2 kick. An exception is shooting foul shots in basketball, where you stand still.

Your 2 feet complement each other in everything you do, whether you're standing still and one foot moves to shift your weight (the other follows), or walking. When running the feet work in pairs: 1-2, 1-2, 1-2. That is steps 1 and 2 are taken, then 3-4, 5-6, and so on.

Tennis is a game of movement. Bipedal rhythm indicates there should be 2 steps prior to

execution, which means you take STEP number 1, STEP 2, and then hit the ball, not pivot, step and hit.

## 2 STEPS PRIOR TO CONTACT, 1-2 AND HIT

When one foot pivots, and the other one steps before the hit, that's only 1 step prior to contact and not 2. The same if one foot drags, or slides while the other steps. This is like taking 1 step before kicking a soccer ball, it's both arrhythmic and underdeveloped.

## TO STEP OR NOT TO STEP INTO THE BALL THAT IS THE QUESTION

The debate is whether there's more power when you hit with an open stance, or when you step into the ball with the front foot. As a teacher and player I feel there is more power when stepping into the ball with the front foot, that is with the left foot on the right side, and the right foot on the left side, than by choosing an open stance. Into the ball is key here. This is detailed further in Steps 3 and 4, and is not the “standard method,” a flawed representation of footwork structure.

All right. What do we know? We need to move forward, both feet step before contact, 1-2, and we want to step into the ball with the front foot. What we don't know is which foot will move first on which side. Luckily, our 2-step pattern of human locomotion can answer this.

When hitting a ball on your right side, your left foot will be the front foot that steps into the ball prior to contact. As such, your left foot is the 2, or the second step, of a 1-2 pattern that occurs prior to contact. This means your right foot is the 1, or the first step. Together they complement each other and form a 1-2 (and hit). On this right side, your right foot is called the back foot, the left your front foot.

It is the mirror image when hitting a ball on your left side. Here the right foot will be the front foot that steps into the ball prior to contact, making the left foot the 1, or the first step, on that side.

In everyday life you move your right foot first when moving to the right, your left first when moving to the left, and your feet work in pairs. It's natural. Why not do this in your tennis?

## MOVEMENT SHOULD BE SYMMETRICALLY EQUIVALENT FROM FOREHAND TO BACKHAND BACK FOOT FIRST / FRONT FOOT LAST AND ALWAYS, ALWAYS, INTO THE BALL

Beginning from the ready position, then, the right foot moves first when moving to the right, the left when moving to the left. And in what direction? Forward (2A, 2B), not to the side or backward, not in-place by pivoting (1D). If you want to go backwards and hit the ball, then by all means step back with your first step. But if you want to move into the ball, then your first step must be in the same direction.

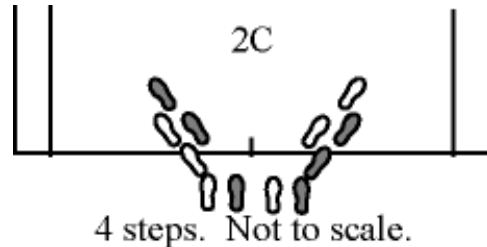
All right. This is what we know. Move forward, back foot first, a 1-2 before hitting. However,

you can't hit groundstrokes well by taking only 2 steps. Either you'll stretch to reach the ball, or your rhythm will be off because while you're ready to hit, the ball won't be there yet. Rhythm is 1-2 and hit, not 1-2 and wait, and wait, and hit.

## 4 STEPS 4 STEPS 4 STEPS 4 STEPS

I've found that 4 steps reaches most groundstroke situations. More steps and you're hitting on-the-run.

When moving to the right, it's right foot first, followed by the left, then right, then left, and contact. When moving to the left, it's left foot first, then right, left, right, and contact. In other words you take 2 sets of a 1-2 movement pattern, 1-2, 3-4. 4 steps (2C). Contact follows the even numbered step, the front foot.



You start with large steps, not small ones, because you need to get moving. Step #1 out of the ready position is the most important because it gets you headed INTO the ball from the get-go. Without it chances are good you won't reach the ball on time.

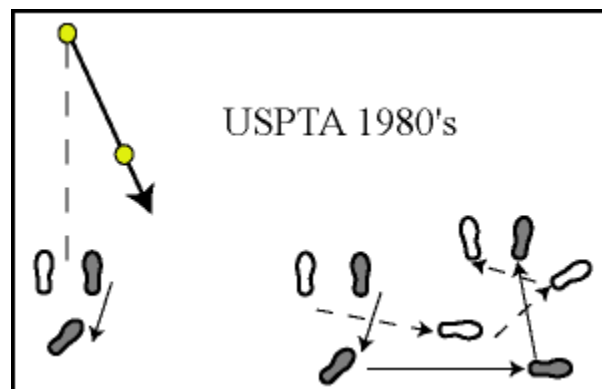
Tennis literature talks about footwork as small, adjusting steps, but you can't build a footwork model based on adjustment steps. Perhaps the confusion lies in the fact that it is the last 2 steps (of this 4 step model) that adjust their stride as needed, and the last one is completely on its own depending on the efficiency of your movement angle into the ball. You need to MOVE, and INTO the ball, and it has to be done efficiently. More follows.

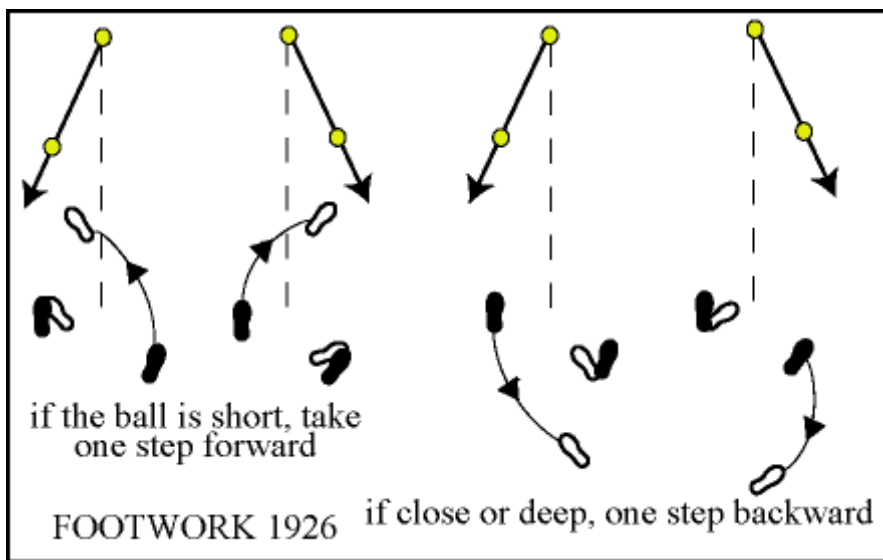
Bear with me, I know you're thinking, "4 steps, way too many." Let me explain.

You don't take 4 steps like you're casually walking across the room, just 4 steps within the amount of distance you have between your ready position and the contact spot. Sometimes they'll be 4 small, quick steps; sometimes the last step will be a stutter step, sometimes it will be a long step. Furthermore, one foot moves past the other and you don't sidestep, as if you were limping.

## OLD FOOTWORK

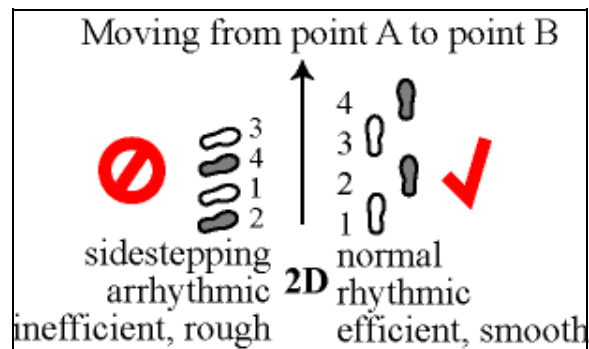
For your amusement, I'm juxtaposing modern day footwork as prescribed by the United States Professional Tennis Association in their book, USPTA Professional Guide, Official Handbook, which teachers have to study to earn certification, and a convoluted footwork pattern from 1926, The Mechanics of the Game, by J. Parmly Paret, as part of the Lawn Tennis Library of instructional books. Though the placement of the feet in the ready position has changed in 60 years, the idea of moving backwards first lives on.





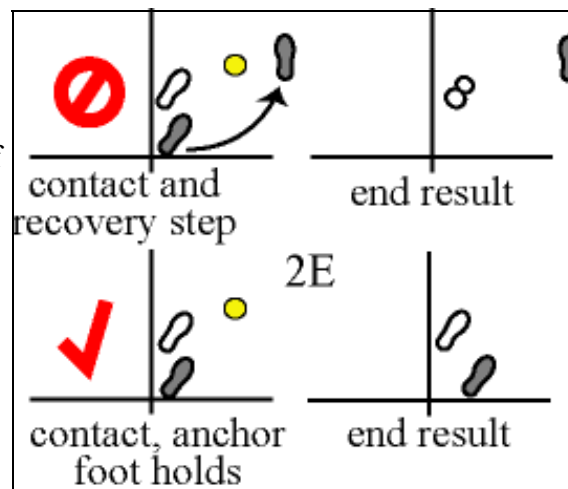
## SIDESTEPPING

Sidestepping, whether forward or off to the side, is an inefficient movement pattern because one foot fails to cover distance by dragging behind and into the other (2D). Instead, both feet should remain pointing forward and/or toward the eventual contact spot as in 2C above, and you shouldn't rush the ball. Sidestepping behind the baseline on groundstrokes to then take one step into the ball is both arrhythmic and finds your momentum moving parallel to the baseline and over to the side fence instead of forward into the ball.



Your steps must continue forward and into the ball (2A,1C). It's common to start forward but veer off to the side and lose the advantage of moving into the ball; it's common that step number #3 becomes a short stutter step instead of a full one, leaving step number #4 to make up distance it shouldn't have to, and you reach, losing balance and structure.

Adding a recovery step to your footwork during your contact makes it harder to get ready, costs you time, reduces your body's support, and inconsistent results follow. Diagram 2E shows the extra distance involved to get ready after the hit when taking a recovery step during contact instead of holding the anchor foot down as best as possible.

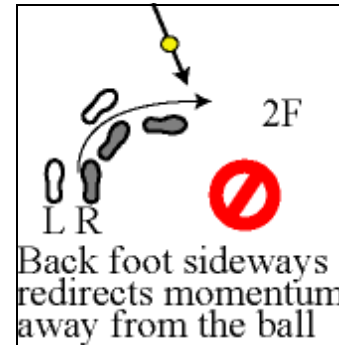


It doesn't matter if you backpedal or turn and run back to get ready. This extra

distance costs you time, of which there's never enough, and the ensuing lack of support from body rotation that naturally accompanies the recovery step is responsible for mishits, as outlined in Step 3 and 4.

A recovery step helps change directions and recovers balance, it is not a part of a footwork model designed to end in contact. Your feet need to maintain their position when you swing to increase the swing's speed, to support your contact spot, to produce more power, and to eliminate upper/lower body movement during contact, the culprit behind stroke inconsistency.

What happens when you do move correctly into the ball but place your anchor foot sideways prior to contact? Not only are you short-changing your court coverage when your penultimate step works inefficiently (2D above), but your momentum gets re-directed away from the ball, 2F.

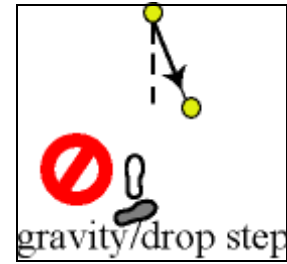
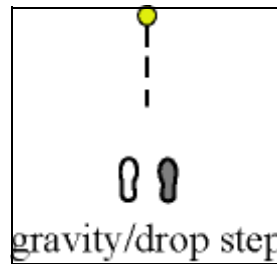


For returns and volleys you only take the minimum of 2 steps because there's both less distance between you and your opponent's contact, and the ball's never as wide away from you as it could be in the backcourt (1A).

### WHAT ABOUT THE GRAVITY STEP?

The gravity step, or drop step, finds the back foot moving first, followed by the front foot. In this sense it adheres to the idea that the foot nearest the ball, the back foot, moves first.

But the gravity step finds the back foot moving in the direction opposite the ball's. The back foot moves backwards, beneath the body toward the other foot, leaving the body imbalanced, almost falling over. It is argued that you move faster by imbalancing the body and having to catch up with it, so to speak.



As I mentioned earlier, there are many ways we move our feet to get from point A to point B. Our experiences have a lot to do with the way we move. I feel the gravity step has developed as a result of turning sideways first, as a result of turning the shoulders, hips, or feet first instead of simply moving (hopefully forward) to the ball.

When the body turns in place your body weight is placed on the foot closest to the ball, that is the back foot. At this point it is impossible to move that foot toward the ball. The result is either the other foot crosses over for the first step, or the back foot drops back under the body, creating imbalance to jump start the body.

Pros have been taught to turn first, then move. The gravity step developed as a compensatory technique to both turn and move, much like the open stance compensates for the fact that stepping sideways doesn't allow the body to empower the stroke (Step 3). But you'll avoid having to compensate if you first move forward to the ball because you turn automatically by moving (Step 4). Less is more.

## **BUT BEFORE YOU TAKE THAT 1ST STEP..... SPLIT-STEP**

Before you take that first step you have to hop in-place, sometimes called a split step. You lift both feet off the ground, you unweight the body, and when you touch down you move more quickly to the ball because your body is in motion to begin with. Your response is much slower if you stand dead still, notice where the ball's going, and then begin to move.

When you split step at the baseline or up close to the net try not to land with your feet too far apart or you won't be able to push off well to get going into the ball. A wide stance means you're holding ground, a narrow one means you're moving. Try to keep the feet closer rather than farther away, a difficult task but one well worth trying.

With a split step you're likely to land and start leaning over to move into the ball, your torso wants to get going before your feet. Moving too aggressively promotes imbalance, which lessens the body's ability to act as a strong foundation for your stroke, Step 5. Your first step won't get you to the ball, it simply gets you going. More importantly, your first step establishes whatever vertical balance you will have throughout the routine, Step 5. Be balanced first, and then make up the distance to the ball with the next step(s).

## **PLAYING AGAINST BALLS HIT DEEP INTO THE CORNERS**

Stand back 5 feet from the baseline in order to keep the ball in front of you/defend against the hard shots into the corner or deep to the baseline. If you take 4 steps on balls really deep and hard into the corners, your body will be too turned to the side to effectively deliver its momentum into the ball (instead, it goes into the side fence).

There is a limit on taking 4 steps into the ball while keeping the body structured well to support the contact, but this limit can be overcome fairly easily.

That limit is roughly halfway to your singles sideline corner, and it can be overcome by translating the ready position farther over to the corner before breaking into the 4 step pattern into the ball. You do this by side-stepping, or shuffling to the side for one two-step pattern, then taking 4 steps. This is the only time a shuffle is needed, it's an exception. Conventional tennis wants you to shuffle all the time and then take but one step, which is arrhythmic, causes you to lose your balance, promotes an open stance, and sends you and your momentum off to the side instead of into the ball.

## **REPOSITIONING**

Repositioning, the bane of all tennis players. It's easy to go and hit the ball, but you can't stay where you are on the court because you'll be strategically out of position. You need to reposition. That means for groundstrokes you need to get back behind the baseline in order to face the center of your opponent's angle of shot-making possibilities.

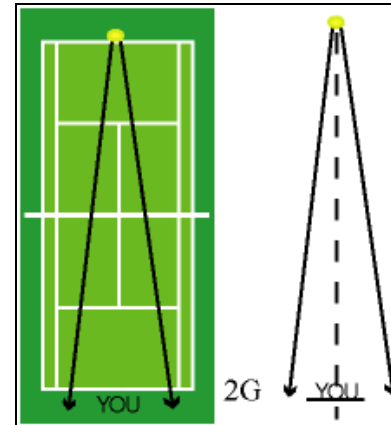
Mathematically, you can always draw a straight line between you and your opponent's contact spot. This line forms a zero degree baseline, away from which the ball angles either to your right or left, no matter how slight or your position on the court. It's as if your ready position is at the 6 o'clock spot on a clock face, the opponent's contact spot is at 12, and the ball goes either to 5 or 7 o'clock. It's rare the ball comes directly at you, more often you move incorrectly and the ball goes



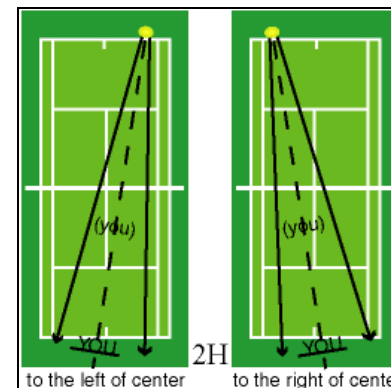
right into your body.

In singles you reposition three to five feet behind the baseline AND slightly to the right or left of the center hashmark, not dead-center (2G). Your opponent's contact spot isn't literally in the middle of his/her court as in diagram 1A, it's always off to one side. If you remain dead-center behind your baseline you won't be facing the center of the angle of possibilities against you, you'll be off too much to one side.

Diagram 2G shows this repositioning effect. You are on the side opposite your opponent's contact spot. In doubles you simply reposition behind the singles sideline corner behind the baseline.



When you're up at the net for singles you're on the same side as your opponent's contact spot. I know it's a bit confusing, but it's part of the same family. For diagram 2H I have simply drawn a line from the ready position in the back court to the opponent's contact spot (the zero degree baseline). If you walk from the back court along this line up to the net, you cross over the middle of the court and wind up on the same side as your opponent's contact spot. For doubles you remain in the middle of your service box and reposition laterally either toward your alley if the ball is hit into your opponent's alley on your same side, or toward the middle if it's hit into the alley on the side opposite you.



## THE FIRST STEP TO EMPOWERING YOUR BACKHAND IS TO IMPROVE THE USE OF YOUR NON-DOMINANT LEG

One reason why your forehand is stronger than your backhand is because the foot that moves first, the back foot, happens to be your dominant foot/leg. You easily move this foot first, and if not, at least it manages to keep the contact spot ahead of you, in the direction of the net, and not off in the direction of the side fence. On backhands, though, your non-dominant foot/leg fails on both accounts, and it drags behind as the dominant foot tries to take over.

In everyday life there is no problem moving to your right or to your left, your feet move easily and unencumbered. You don't make the distinction, "this is my backhand side, it's weaker, I should go around and approach it from my forehand side." The first step to empowering your backhand is to move your back foot first and forward and train it to keep you moving into the ball. It's awkward at first, but you will get to the ball faster, your momentum will be directed into the ball, and when combined with other elements to come, you will be establishing a strong foundation with the body from which to empower your stroke. I used a ball machine. I held my left foot in the air and moved it forward when the ball appeared. And I took 4 steps, making sure my left foot moved forward on that third step.

Why is hitting open stance popular with the pros? Conventional tennis teaches the front foot to

step first by doing a crossover step. Here the back foot pivots against the ground (1D) and the front foot takes a step as step #1. The back foot becomes step #2 and contact is made in an open stance.

An open stance is rhythmically sound when the first step is a crossover step (step #2 leaves you on the back foot). Furthermore, pros starting with a crossover step avoid stepping into the ball with the front foot because one more step throws the 1-2 and hit rhythm off into 1-2, 3, and hit. And they've experienced that stepping sideways with the front foot doesn't empower the stroke, as explained in Step 3.

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## ADDENDUM

Anyone watching Roger Federer has undoubtedly noticed he sidesteps once, or twice, then steps to the ball with the front foot (or remains in an open stance), yet he also moves in the more conventional 1-2 manner as described in this **Step**. He is not alone in this. Is this sidestepping footwork pattern something to emulate?

I wrote earlier in the "Sidestepping" portion above: "Conventional tennis wants you to shuffle all the time and then take but one step, which is arrhythmic, causes you to lose your balance, promotes an open stance, and sends you and your momentum off to the side instead of into the ball." I still believe this, especially when teaching how to play. And evidence for me remains clear in both student and pro of the extra challenges created by a sidestepping movement pattern.

So why does Federer do it? The sidestep pattern is used when, ironically, the ball is coming fast. Why? Keeping the ball ahead or in front of you increases the chances of hitting on time because it opens the hitting window (visually, physically). Using the 1-2 pattern to move fast to a fast ball can turn the body away from the ball, which also turns your head and momentum to the side, whereas using the 1-2 pattern to move fast to a ball that is not so fast doesn't turn the body so dramatically.

The sidestepping pattern on a forehand keeps you, or Federer, in an open stance, from which you choose either to remain that way and hit open with the weight on the back foot or step the front foot in-place (open forward stance), or choose to take a more forward step with the front foot forward into the ball (forward stance). A one-handed backhand leaves little choice but to step with the front foot (open stance is done better using the 1-2 movement pattern), whereas a two hander has the same choices as with a forehand.

Lots of pros use the sidestep pattern, but when *we* do it something's amiss because it doesn't work like with Federer. Why? The first drawback of this sidestep pattern is you don't cover distance as you would using in a normal, 1-2 pattern, and pros attempt to overcome by being top athletes. And though the sidestep pattern seems simpler there are other prices to pay besides getting into shape like a pro athlete to help make up for this inefficient movement pattern.

With the sidestep movement pattern you have to prepare the swing not only sooner but the adjustments at the end are made more demanding; you have to fight harder to keep your balance before and during the swing since your momentum's sideward direction is at odds with the stroke's more forward direction into the ball; and with only one step before the hit the whole thing is arrhythmic. This is all very difficult to do, it is far too easy to lose the prep work, the balance,

the momentum redirection, or the overall rhythm using one step, let alone getting close enough to the ball to begin with so you don't have to adjust/make up for distance. This explains why, even when the pros do it, they don't execute like Federer. He alone remains well balanced and stabilized during his shot, two cornerstones to his success his peers try to emulate but can't.

Federer's overall composure on the court is the reason he's number one, that is his talent in many areas (moves well, balances and counter balances, stabilizes, vision, etc.). You can certainly sidestep and hit the ball like he does but remember how challenging it really is because it taxes so many other areas. And if your game is a bit off stop the sidestepping and work in a 1-2 movement pattern instead to re-ground your rhythm and get the feet moving again a little better.

## OLD THINK

- move foot A first if ball is short
- move foot B first if ball is deep
- move opposite foot first if ball is far
- move closest foot first if ball is close
- small steps, then large ones
- get going with large steps
- stutter steps, side steps, crab steps or drag one foot behind you

## NEW THINK

- right foot first to the right, short or deep ball
- left foot first to the left, short or deep ball
- get going with large steps
- 4 steps groundies, 2 on volleys

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## Step 3

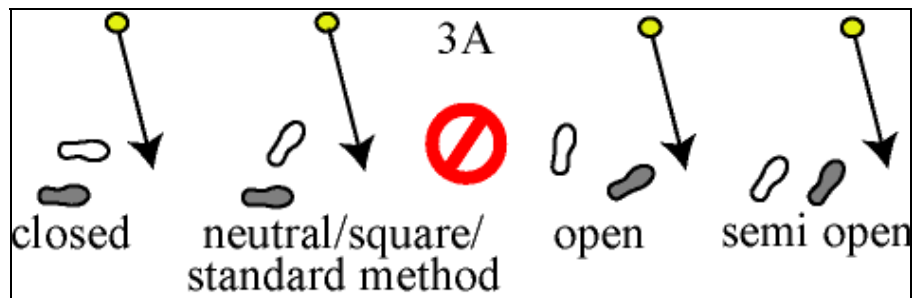
### Your Body's Power Zone

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Steps 1 and 2 begin to explain how to structure the foundation, your body, to empower your stroke. Move into the ball using your natural locomotion for rhythm and efficiency..

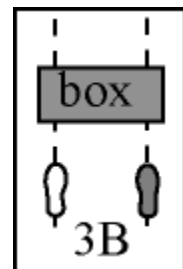
Step 3 explains the relationship of your feet and body to the contact spot and the result is a new stance for tennis players: the forward stance. First, let me illustrate the popular stances known today as outlined by a self-described tennis guru. Diagram 3A shows the closed stance, open and semi open, and the neutral stance (also known as the standard method, the square stance).



The stances in 3A are all but derivations of a main theme. The main theme is based both on the body's structure and our desire to move into the ball as seen earlier. First, let me explain a simple thing about the body's structure before arriving at the main theme.

It doesn't matter whether you kick or hit a ball, tackle someone, lift a bag of groceries or a heavy box, all of these actions take place in a zone common to us all. This common zone lies between the width of the feet where the feet are for the most part parallel to each other, and you can see this zone if you look at the act from a bird's eye view and extend lines straight away from the toes.

For example you don't stand sideways to a box and try to lift it, you stand facing it where the box is between your feet and your feet are parallel, or identical, to each other (3B). And, you wouldn't think of turning your body center to the side before lifting.

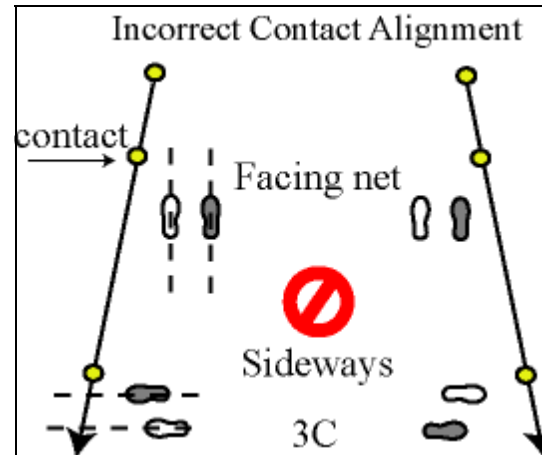


I call this common area your body's power zone. Not exactly in the middle between identical feet, simply in between them and not to the outer side of either one, and the center of your body, the groin area, faces straight ahead in the same direction as your feet.

For example, a golf ball lies between the width of the golfer's feet, and the body's center faces the

ball at contact. A baseball batter, standing sideways, takes one step and swivels both feet to make them identical and to place the contact between them and in front of his center. This is, initially, how your body structures itself to empower whatever it is you're doing with your arms and hands, and the height of the action is secondary to this.

The contact spot for a tennis player is our task, and as such the contact spot must line up between the width of identical feet in front of the body's center for the body to empower your swing into the contact spot. This is the same as your body empowering your arms to lift the box. But diagram 3C shows how this fundamental alignment does not occur when the front foot steps sideways (and contact is made out in front/ahead of the front foot), or when both feet face the net, often misunderstood as the open stance.



Your strokes are unsupported in 3C because the contact does not lie between the width of the feet, even though the feet are parallel or pointing in the same direction. Diagram 3C is the tennis player's equivalent of standing sideways to a box and lifting it.

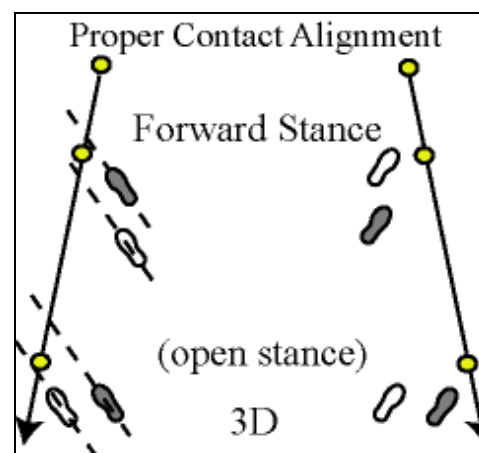
You may think some of the popular stances shown in diagram 3A above may meet the dual requirement of hitting the ball between the width of identical, or parallel, feet. You are half right. Either the contact spot will not lie between the width of the feet (closed stance), or the feet are dissimilar (neutral, open stance). Only the semi open stance meets the dual requirement of contact between the width of identical feet, but, as with the open stance, you're standing still on the back foot prior to swinging instead of stepping forward into the ball.

Each stance in 3A requires you to compensate for the fact you've been moving off to the side instead of into the ball (1D). As a consequence you'll rotate the body to deliver momentum into the ball to support your stroke, but that's a compensatory and counter-productive technique that adversely impacts your swing, Step 4.

## THE FORWARD STANCE

What is the forward stance? BOTH feet are identical, BOTH feet have been moving into the ball, and you step into the ball with the front foot prior to contact (that occurs between the feet). The back foot is not sideways because it's been moving into the ball per Step 2. You've experienced this alignment structure when hitting on-the-run moving forward into the court. The feet here are never sideways or dissimilar during contact (that occurs between the feet).

If you follow Steps 1 and 2 for groundstrokes and volleys, the result is the forward stance, the result is strength. With BOTH feet moving into the ball, or



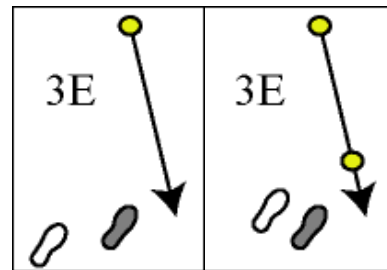
pointing into the ball, stepping into the ball with the front foot prior to contact finds both feet identical and the contact between their width (3D).

Diagram 3D also includes what I consider a proper open stance, which is called a semi open stance in 3A. Contact is made between identical feet, though very close to the back foot. You won't be at full strength with an open stance because it's like placing the heavy box closer to one of your feet instead of in-between them before lifting it, and you're not stepping forward into the ball.

The forward stance, for a tennis player, is the main theme. You should plan to use it more often than not. But, if you can't get to the ball in time, use the open stance. If the ball is just too close and too fast, use the open stance. If you don't want to move into the ball to begin with or step into it with the front foot before you swing, use the open stance, or the neutral stance of diagram 3A. If you need to compensate, go ahead, just don't make it the heart of your game. These stances can work, but they make you work more for your shot. And with **Revolutionary Tennis**, remember, less is more.

### THE OPEN FORWARD STANCE

There is an open forward stance that accommodates fast balls and high balls for a western grip which I'm seeing on occasion in the pros. Prior to contact, 3E left, the front foot prepares to take the last step prior to contact, the 2 of a 1-2 and hit rhythm of Step 2. It steps into and toward the ball, 3E right, but it doesn't take as long a step as with the forward stance. Instead of planting your back foot before swinging, the open forward stance allows you to take a (small) step forward into to the contact.

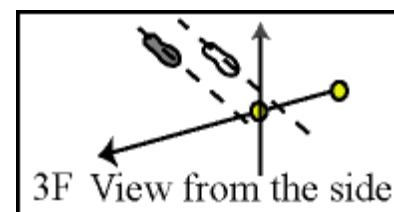


### HIT OUT IN FRONT?

What about hitting out in front, or ahead, of the front foot?

This is a old misconception brought by the closed stance (or was it the other way around?). Today's tennis still urges you to stand sideways and hit out in front/ahead of the front foot. This means contact is made to the outside of the front foot, which leaves you unsupported, and as a result the open stance developed. Well, hitting out in front/ahead of the front foot

seems to be happening when you look at the contact spot from the side, 3F. But if you look at the contact from the body's point of view, you would see it lies between the width of the feet and in front of the body's center, not out in front/ahead of the front foot. This is the alignment structure for a strong hit. "Out in front" really means don't hit late.



The contact zone has always been described as optimally located between the hips and the shoulders, a location that suggests height is everything. I don't know about you, but the tennis ball never sits at just the right height when I hit it. Instead, the contact zone should be seen as lying between the width of the feet, allowing you to strike the ball at whatever height. After all, there is only one moment in time when the ball can be hit on time, and height is secondary to the contact's horizontal placement between the width of the feet. Contact too far ahead and you're

too soon, and once past your body's center you're late, no matter the height. Step 7 elaborates more.

I'm sure you've seen a photo or two of a pro's front foot almost pointing straight to the net on a backhand, looking a little awkward. Next time you do, look at the back foot's position. It will invariably be sideways, parallel to the baseline, pointing to the side fence, or even the rear fence, indicating the pro has not been moving forward into the ball. At this point the pro opens his/her front foot awkwardly to valiantly place the ball somewhere between the width of the feet. The instinct is natural to do this, but it's hard to accomplish when sideways first.

Yet another difference between backhands and forehands can be seen here. There is a fudge factor regarding the contact on a forehand. The ball can be hit later, or closer to the back foot, because the racket arm is on the same side as your back foot. On the backhand there is no margin for hitting later. The racket arm is on the same side of what is now the front foot, and the contact spot lies almost even with the front foot. This is why a backhand open stance is becoming more popular, you can hit later.

If you're sideways, should you then swivel one or both feet, like a baseball batter, to place the contact between them and in front of your body center? If you're in an open stance, should you rotate the body to generate momentum? You could, but you'd be adding layers of difficulty unnecessary for tennis, as explained in Step 4.

Turning sideways, moving parallel, taking small steps to move, dragging one foot behind you, stepping across or sideways, using an open stance, each one works against developing a strong foundation with the body. No wonder your strokes suffer.

An even greater misconception is how to achieve power, Step 4.

## OLD THINK

- contact out in front
- stand sideways
- step towards the net
- step towards ball placement
- face the net
- neutral stance
- open stance
- semi open stance

## NEW THINK

- contact between the width of the feet
- face the ball
- both feet point and step towards the ball
- both feet are identical
- forward stance

# Revolutionary Tennis

Tennis That Makes Sense

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## Step 4

### Your Body's Power

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To step or not to step into the ball, that is the question.

Does your body empower you more when you move into and step into the ball, or when you remain in an open stance? Or when you throw the back leg around from an open stance? Well, try pushing someone away from you, or throwing a ball, without stepping into what you're doing. The answer is clear: move, take that step. How about accuracy? Ever throw a ball while aggressively swinging your back leg around? You have no accuracy.

Power means shifting body weight. The weight is shifted, creating momentum, into your body's power zone to empower your arms or legs. There's acceleration with the striking mechanism (hand, leg, bat) for more pop, but it's the weight shift that counts.

You can shift your weight in a variety of ways, and instinctively tennis players are always trying to shift more weight into the ball. But what we want is a system that gets the most bang for the buck and can be repeated easily. All athletes are trying to achieve power with the least amount of energy expenditure possible because overdoing things leads to injuries and inconsistent results.

Two terms used for momentum: linear and angular. I know biomechanists would add minutiae to my descriptions, but I want to keep it simple. It's angular momentum when the body rotates the torso and/or hips, like a golfer or baseball batter during a swing, and it's linear momentum when the body shifts straight without rotation, like moving straight into someone and pushing them away from you.

Every tennis manual asks you to rotate your body for power like a baseball batter or golfer when swinging, but consider this:

### WHY DO YOU HAVE SO MUCH POWER HITTING ON-THE-RUN MOVING FORWARD INTO THE COURT WHEN YOU HAVE NOT ROTATED ANYTHING AT ALL?

You know the example I'm talking about. The ball's short, you're forced to run forward, you hit while moving (on-the-run), and at times you have too much power. Absent rotation, what's going on?

You're using linear momentum from the body for power when hitting on-the-run, not angular momentum, AND it's being directed solely into the ball and not along the ball's flight line toward



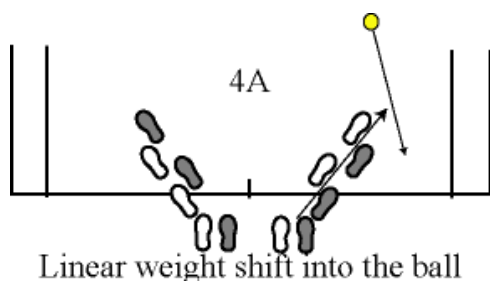
the opponent.. (The swing is angular, yes, because it goes around, due to the arm.) By following Steps 1 and 2, your momentum moves into the ball. Linear momentum shifts weight in a straight line, and believe me, it's enough of a power supply for you or any other tennis player.

I know what you're thinking, this is crazy, but I'm not advocating hitting groundstrokes on-the-run. I'm arguing what's right for tennis based on the game's point of view, and the body's point of view. Let's compare tennis with golf and baseball to see if we're talking apples and apples, or apples and oranges.

|              | <b>TENNIS</b>                                                     | <b>GOLF</b>                             | <b>BASEBALL</b>                    |
|--------------|-------------------------------------------------------------------|-----------------------------------------|------------------------------------|
| the ball     | angles away                                                       | lies still                              | thrown at you                      |
| the player   | moves to the ball and back                                        | stands still                            | stays in a box                     |
| 1 point      | is many hits                                                      | is one hit                              | may hit once after series of tries |
| playing area | 39 feet long, 26 feet wide and begins up to 39 feet away from you | hundreds of yards away, 10's yards wide | hundreds of feet long and wide     |

Tennis demands movement into a ball and stroke repetition, all within a small playing field. Except for the hand-eye coordination, a golfer or baseball batter's body technique during the swing is of no use for a tennis player because their realities are much different. Body rotation for power is required when the player does not or can not move, moves very little, or the field is large. It's clearly apples and oranges when comparing tennis with golf and baseball.

Steps 1 and 2 describe moving INTO the ball with 4 steps on groundstrokes. When you move INTO the ball your linear momentum is also directed INTO the ball, they go hand in hand. Movement equals power. Movement into the ball automatically places the contact between identical feet, Step 3, and delivers power into the ball (4A, 4B) without the need for compensatory technique.



## LINEAR MOMENTUM "INJECTS" POWER ON A STRAIGHT LINE

The back foot doesn't stay flat on the ground, it goes up on its toe when you shift into the ball. You already know how to do this. Get up and walk s-l-o-w-l-y. Notice how your weight goes

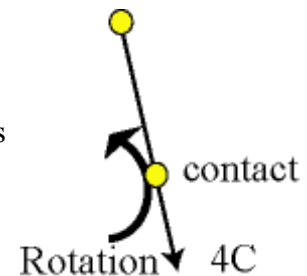
from one foot to the next, and how each foot moves heel to toe. The back heel lifts, leaving only the toes touching the floor when shifting onto the front foot.

On the tennis court keep moving into the ball to shift the weight into the ball. Don't hesitate, pause, or pull back. I know that sounds obvious, but imagine you want to kick a soccer ball back down field and you're told to run toward the sidelines, get "in position," and then kick it. Or you're told to run up to it, turn, shift your weight back away from the ball, and then kick. These two examples represent the standard advice on weight shifting for tennis players. Less is more.

## WHY NOT BODY ROTATION?

Body rotation is designed to shift weight if you're not moving into the object to begin with, or if you're standing still prior to contact. But a tennis player gets to move, and should take advantage of this huge benefit by moving into the ball instead of to the side fence.

Body rotation by definition means the body rotates inward from the contact spot, no matter the sport. From overhead, the trajectory of a tennis ball is a tangent line, angling away from the player, and it continues to angle away at contact. The direction of the body's rotation here is inward from the tangent line, inward from the contact spot (4C).



Or look at it this way. Stand and face your computer monitor. Draw an imaginary line perpendicular to it from your navel. This line has a fixed length to it. Rotate your body to one side and notice how your imaginary line arcs inward from the monitor.

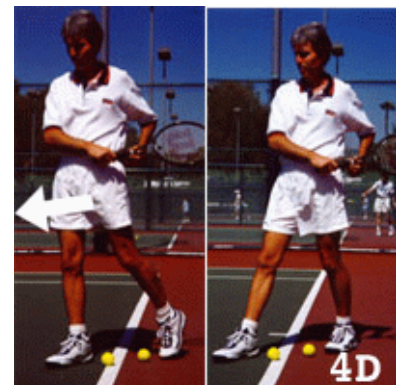
As a tennis player you face the reality of a ball angling away from you. If you rotate your body during the swing, this means both your racket and your body are moving away from the ball at the same time the ball is moving away from you. ¡Ay caramba!

Linear momentum is an easier and more reliable source of power than angular momentum. Its mathematical equation is simpler as well. When a tennis player rotates, it's overkill, counterproductive, and everything gets more complicated. What happens when a golfer or batter tries to hit the ball harder? They rotate more, and their accuracy suffers.

## LINEAR BODY WEIGHT SHIFT

The length to the linear shifting of your body weight is small. This is the main advantage, there is very little "shifting" to do since you've been moving into the ball. The tennis balls placed below the center of my body in photo 4D represent this length, and the arrow shows the direction of the shift. Aggressive players will add more length to this shift by taking a longer stride.

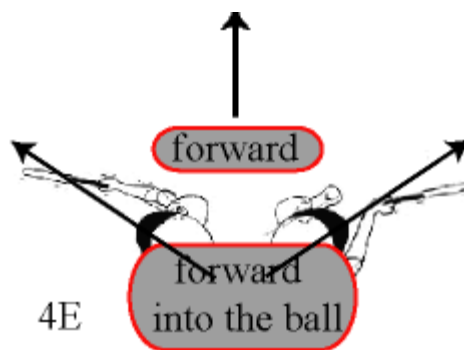
Let me show the direction in which your weight shift should proceed. 4E shows the difference between shifting your weight forward into the ball, or shifting it "forward" toward the opponent in the direction of your stroke, which isn't forward



into the ball. You shift into the ball, and there is only one direction for that.

If you're like most players, often your momentum has been going to the side fence. You're sideways, and to compensate you'll rotate your body to redirect your momentum more into the ball. Unavoidably, this rotation adversely impacts your stroke.

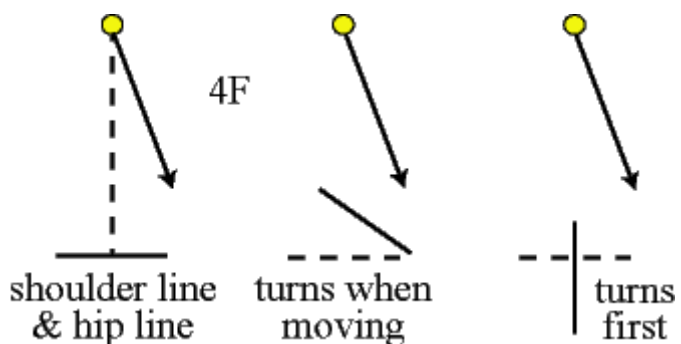
Or, you'll rotate your body to generate momentum from an open stance because you've stopped moving, you won't step into the ball. Ironically, this momentum from rotation will not go into the ball but away from it, the largest single source of unforced forehand errors in the pros. On a replay after the pro has netted an easy forehand, notice how severely he or she rotated the body inward from the contact spot toward the opponent's side of the court, that is away from the ball.



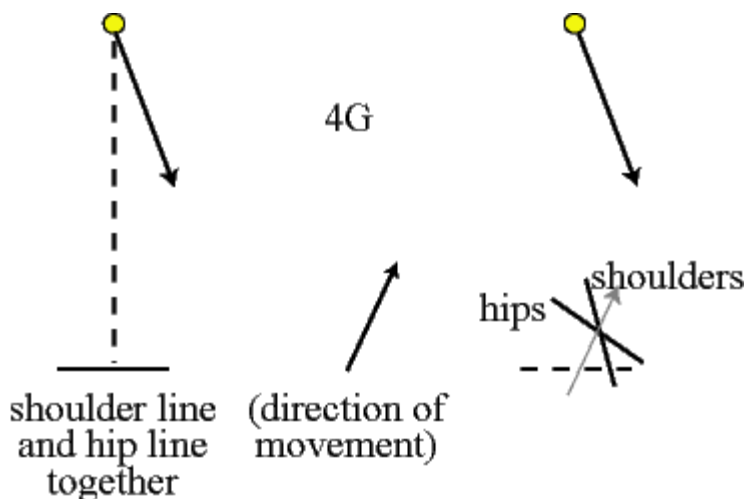
I know the idea of no body rotation is different. It runs counter to the established method. Well, if you move into the ball correctly with both feet, step into it with the front foot, shift your weight linearly into the ball, and don't rotate the body during the swing, you'll be amazed at how strong your contact is with linear momentum as a power source. Large muscle groups are still responsible for transferring weight, only now their contribution is linear, not rotational. This is a new idea. **Revolutionary.**

## LESS IS MORE, SIMPLE IS BEST

Let's talk about turning the body, because I know the popular idea is to "turn" the body when you take the racket back. First, when you move you automatically turn the hips and shoulders, it doesn't work the other way around, shown in diagram 4F. Movement = turning, as illustrated when hitting on-the-run forward into the court. Very few students move across the court with their shoulders parallel to the net.



Second, if you turn first, you've turned the body and its momentum away from the ball. With this over-turn, you'll have to re-turn the body into the ball to support the stroke at contact. All of that adjustment, especially in such a short amount of time, adversely impacts any swing. Compensatory technique should not be offered as a model.



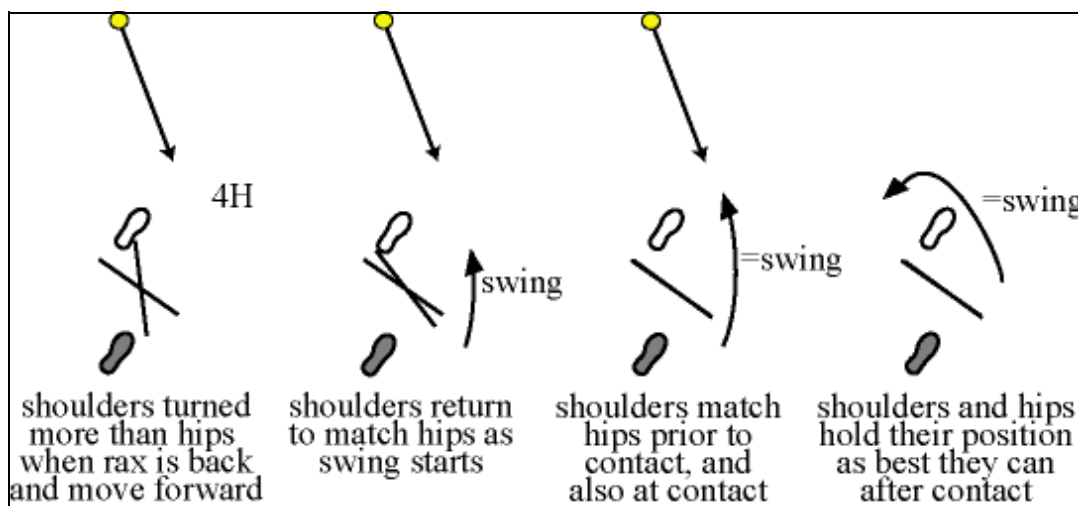
Third, and last, what about the popular idea of turning the upper body a lot

first, winding it up, to accelerate the stroke more via rotation? Step 6 elaborates on why this doesn't work, but for here let me refer you to diagram 4G. As long as your hips and feet (your body center) lead you into the ball there will be a limit on upper body rotation, or wind up. If, however, you allow your hips (body center) to turn more because the upper body winds up, you'll find yourself and your momentum no longer moving into the ball but away from it. Your stroke then needs more time to curve its way around to line up into the ball, and, more importantly, hitting on time becomes more difficult to achieve (more on this in Step 7).

### **FOR ADVANCED PLAYERS...and those who aspire to be**

I have received a lot of feedback regarding upper body rotation on a forehand. For advanced players the answer is yes, there is some, if you want to call it rotation. But when I asked a student of mine who's an attorney whether or not she considered what follows to be rotation, she answered, "Not really, because I'm trying to lock my torso after a point." Let me explain. What follows also applies to two handed backhands.

Diagram 4H begins, like 4G before, showing the limit to the upper body's coiling, or turning, while moving forward into the ball. Next, during the forward swing, the torso re-turns to match the angle of the hips beneath it, something it wants to do quite naturally. And if the torso stops when it matches that angle it acts as a boost to get the racket going. By stopping its limited rotary movement, the torso helps accelerate the racket ON ITS OWN. This is similar to cracking a whip, where the handle stops and the rest of the whip accelerates and continues beyond it, or similar to a hammer throw, where the body prior to release stops its rotary movement to help the arms accelerate the throw.



The stroke does not accelerate as much as explained above if the shoulders continue to rotate (and the hips) in the direction of the swing and wind up facing the net. There is a point in tennis where rotary movement becomes counterproductive to stroke speed and contact control, a point easily breached when either hips or shoulders rotate to face the net in an effort to accelerate the swing. Tennis is not golf or baseball. We need to move, adjust our stride and closeness to the ball, adjust the stroke, exercise more control over the hit, keep it in a small playing area, and get ready to do it again a few more times for one point.

I'm including a photo here of the great Stan Smith to illustrate the movement in 4H. Stan's explaining something about hitting down the line with these two photos, but a few things prominent to **Revolutionary Tennis** stand out even though these aren't mentioned in the article. It's clear that 2 steps are taken prior to contact and that both feet are identical, or pointing into the ball (Step 2). Stan's shoulders are turned more than his lower body (photo left), and then his shoulders re-turn to match the hipline (right) per diagram 4H. His contact spot lies between the width of his feet (Step 3), and his overall posture is good (Step 5). This photo by Fred Mullane appeared in Tennis magazine.



How can you learn the movement described in 4H? First, move into the ball and don't coil the upper body as you begin taking the racket back. Your torso will be turned slightly like your lower body. Then step into the ball with the front foot, shift your weight linearly, and swing without moving your torso or hips. A common teaching tool is to freeze after contact, that is follow through and freeze. The "freeze" stops body rotation and produces a strong hit.

As a teacher I find students naturally turn the torso slightly on the forehand when taking the racket back, and they naturally overrotate the shoulders forward with the swing. I guess you can't have everything. So my job is to get them to stop that forward overrotation to improve their stroke.

Some players hit successfully after both moving parallel to the baseline and rotating the body. This is good enough, from time to time, but it's harder to make this style consistent because rotation compensates for not lining up properly INTO the ball to begin with. When faced with a harder or wider ball, the weakness in this style is exposed. Furthermore, this kind of player would like to have more power yet keep the ball in. How to? Cut down on the rotation, and try moving into the ball to begin with.

Contact, for any sport, is preceded by shifting body weight into the contact area, you shift and hit. For tennis players it has been said that the timing of the rotation of the body (body weight shift) with the swinging of a racket onto the ball is crucial for success. Wrong sport. Tennis players need not rotate like golfers or baseball batters. Nor should they. And if your power isn't what you want even though you're moving into the ball and using linear momentum for your weight transfer, Step 5 will assist you.

Using a metaphor, the perfect swing works as smoothly as a child's swing swinging back and forth between the legs of a swing set. But if Mr. Bully picked up the legs of the swing set and twisted them, the swing would no longer move smoothly, it would fly off to the side. This is what happens when you rotate the body while swinging the racket, the racket can't line up into the ball smoothly.

## CHILDREN AND JUNIORS

Promising young tennis players jump and rotate their bodies dramatically because they want to hit the ball hard. Force is a product of mass times acceleration. Young kids don't weigh very much

and aren't very strong, so they throw every bit of mass they've got at the ball to get more zip. As they get older they will naturally hit harder due to weight gain and increased physical strength but their jumping and twisting motions will prove counterproductive in adulthood.

Power and strength develop naturally as children grow older. Since rotation is anathema to success for an adult tennis player, children shouldn't nourish a set of skills that will hurt them in later years. It doesn't make sense, but it happens all too frequently.



This photo, by Red Morgan, from *I believe Tennis Week*, is worth more than a thousand words, but I'll try to be brief. The well intentioned teacher has the boy standing still and sideways, and will drop the ball for the boy to hit. The boy learns to wind up a lot to hit with power precisely because he is standing still, in effect becoming a baseball batter. But tennis isn't baseball where you get to stand still waiting for the ball, the boy needs to learn (how) to move into the ball and balance, or reconcile, that action with his stroke and not the

other way around. You can say the teacher is trying to work solely on the boy's swing and that I'm being too critical, but this teaching method is very common: both feet are sideways, the wind up is large, the ball is dropped by the boy's side, and the front foot will step toward the net instead of into the ball. Extremely unrealistic.



What would I do here instead? Let me refer you to the Stan Smith photo above where he's taking 2 steps forward into the ball and both feet point identically into the ball. Or look at the young girl in the black and white photo on the left by Russ Adams. Her feet are pointing correctly, she's not standing sideways. Children do so many things naturally, don't they?

I would ask the young boy to start taking his racket back as a loop (explained more fully in Step 8 part II, *How To Help Your Forehand*). I would drop the ball ahead and in front of him (in the direction of the net post to the boy's right), and I would ask him to take 2 steps forward into the ball before striking it. In this way the young boy would absorb all the

elements to improve his game: stroke preparation, 2 step minimum forward movement, stroking with the body's momentum behind it.

Juniors wonder why their mechanics fail them, and they are told inaccuracy can be overcome by quality practice. That is practicing how to turn sideways, rotate, shuffle step... The standard technique lets us all down.

It's very easy to get kids to move into the ball and hit well without rotation. But it's hard for them to see they're establishing a foundation, like roots on a tree, that will allow their game to grow unencumbered by compensatory technique.

You can do Steps 1, 2, 3, and 4 correctly and still not maximize your power. That's where Step 5, Strength & Stability, comes into the picture.

## OLD THINK

- angular momentum
- rotate hips/shoulders during contact
- shift weight with ball toward opponent's side

## NEW THINK

- linear momentum
- shift straight into the ball/contact



# Revolutionary Tennis

Tennis That Makes Sense

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## Step 5

### Control Your Power

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mark@revolutionarytennis.com

Conventional tennis emphasizes what you look like after you've hit the ball, that is, follow-through up high, hips/shoulders face the net. What your body looks like at contact is everything, not what it looks like after you've hit. The contact is the climax of events in tennis, not ball placement. Without quality contact the ball won't go where and how you want it to.

#### **AT CONTACT YOU CAN LOSE YOUR FOUNDATION**

At contact it's not just enough to hit the ball on time, you have to avoid losing your foundation in the process. You have to avoid jumping, twisting, rotating, leaning, moving back, or projecting your body weight somewhere else other than into the tennis ball. Power from the body (weight shift) is projected into the ball at contact, it isn't projected along the flight line of the ball toward the opponent.

But, you ask, isn't moving into the ball enough? It's most of it, but you can still lose your foundation here as well.

A tennis ball is never "right there" waiting to be hit. At contact it still angles away from you, and when you hit it, it hits the racket back in an equal but opposite direction. When you shift your weight prior to contact, you can rock back equally in an opposite direction. And the swing's angular momentum pulls you away from the ball at contact, that is it pulls you away from the direction in which you've been moving your body weight (into the ball).

To get the results you want, you need to avoid being pushed around during contact by the forces of physics. You're not going to win that battle, but you can deny it as best you can. How? By structuring the body into a position of absolute strength.

Your body is in a position of absolute strength when it is optimally balanced for the task at hand and maintains that balance during the task. If you pick up a box you and lean side to side or bend over, you lose strength. While you can be balanced when on your back, squatting, or sitting in a chair, you are strongest with your arms when you're standing.

$$\begin{aligned}\text{ABSOLUTE STRENGTH} &= \text{BALANCE} \\ \text{BALANCE} &= \text{MOVEMENT} + \text{POSTURE} + \text{FINAL POSITION}\end{aligned}$$

A body that is balanced physically is a body that is strong. The structure involved to project this strength was first developed for both dance and self-defense and can be seen today in ballet and the martial arts. I learned this structure when I voluntarily took some private ballet lessons to

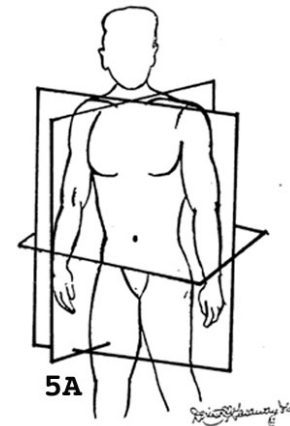


compliment my therapy following arthroscopic knee surgery.

The physical structure to balance is universal and can be applied to tennis more easily than for either golf or baseball. Yea for us, and we don't have to turn our feet out.

I define balance here as movement, posture, and final position. Diagram 5A shows the three planes of the human body. What structures your body-as-strength the most is when:

- 1) both your shoulder line and hip line remain parallel to the ground beneath them;
- 2) your torso is back, upright, shoulders back and relaxed;
- 3) your hips are thrust, or tucked under, in a forward position.

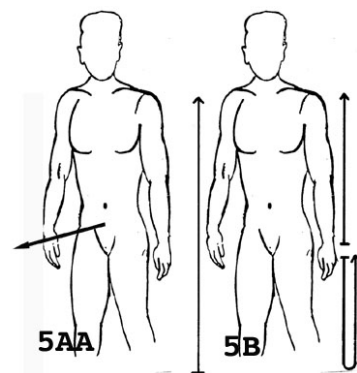


### MOVEMENT & THE BODY CENTER

There are all sorts of ways people walk. Watch the world go by on a street corner and you'll be entertained by the variety of styles. But there is an optimum way to move when athletic activity is involved.

The most efficient way to move any object is to move the center of the object. The center of the human body is the groin area, and, to be efficient, the body's center should move you, or pull you, forward. To do this, the hips must sway into the forward position. Too often your torso leans over first and then you move, and/or your rear end is cocked back.

Move first from your body center, 5AA. Don't push off from your feet or lose your balance to force yourself to move. A dancer's grace and balance comes from moving his/her center, and a dancer jumps very high not because s/he pushes his/herself up off the floor with the feet (5B, left arrow), but because the body center both lifts the body beneath it and pushes the body above it (5B, right arrows).



The torso and head are back when the body center moves first. The upper body appears to float above the lower body, with the lower body doing the most work. Unencumbered by having to counter any imbalance, the lower body and midsection can then provide maximum support to the arms. The end result is the strongest foundation possible when hitting or striking. Power.

The body's center and its usage is the end-all and be-all of any physical movement or endeavor. Balance and power flow from the center, are sourced from the center, and are available to you when the fewest forces act against the center. Rotating the body's makes it harder to maintain balance and source your power, unlike when using linear momentum to shift your body weight.

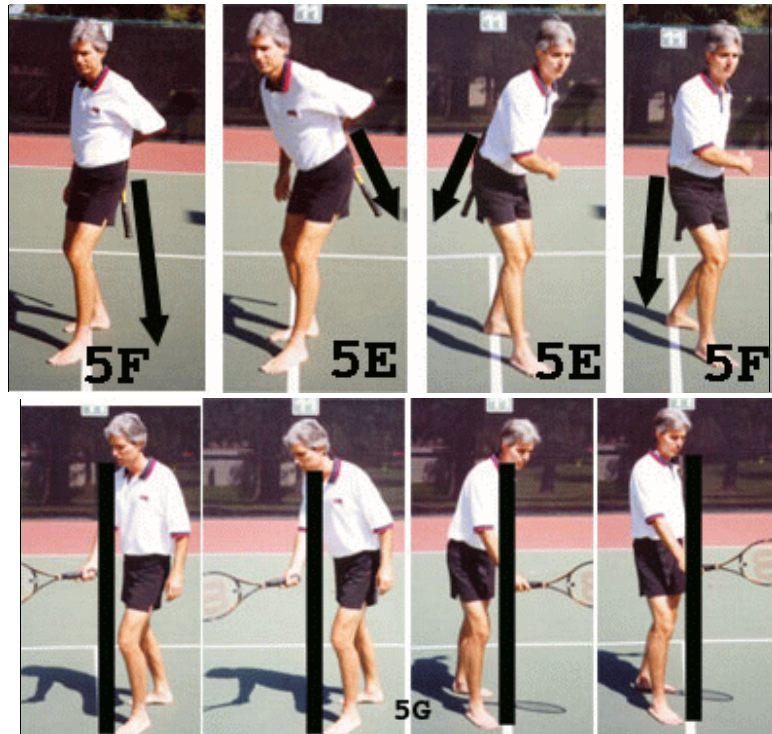
## POSTURE

Good posture means you stand upright in your torso, head back, shoulders pulled back and relaxed down. Your hips are tucked under in the forward position so that your tailbone points down, 5C arrow, and your shoulder line and hip line are parallel to the ground below.

Commonly, there's a horizontal understanding to balance, as when you extend your arms out away from you (horizontally) to keep from falling over. But what's really going on is you're trying to achieve vertical balance during your routine, achieving balance from between your feet up through your groin and torso and into your head, as in when you stand up straight, or balance a book on your head while you walk. I've drawn a line on photo 5D to represent this vertical balance.



When the hips are cocked back you lose your balance and thus power. This posture that relates to the tailbone pointing out instead of down is common in all players, including the pros when they want to tag a forehand, and helps further explain a backhand's weakness. In photos 5E and 5F I'm holding my racket behind my back and using the arrows to illustrate where my tailbone is



“pointing.” In 5E the tailbone points out, which means I’m not strong because I’m not balanced, my hips are cocked back. In 5F my tailbone points down, it’s in a normal position, and how I have power from the body available for my stroke.

Good posture further means the torso doesn't lean over so that your head extends beyond the toes, as represented by the black line in the two inner photos in 5G. If you're familiar with lunges, you know the knee doesn't extend past the foot as you lunge, nor does it turn inward or outward. A similar alignment structure applies to the torso with respect to the lower body, the torso and head should not lean out past the feet (or backward), the two outer photos in 5G.

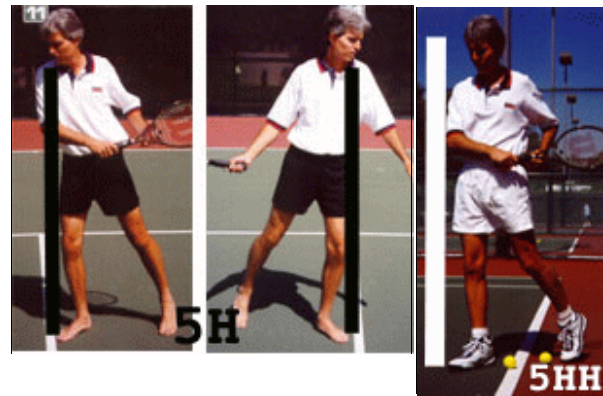
A popular idea in tennis teaching is to lean into the ball, 5H. This means your torso extends sideward beyond the width of the hips and out past the knee and foot, a clear indication of losing balance. 5HH shows vertical balance, not leaning sideward into the ball, no leaning over, tailbone down. Aggressive players will get down lower than I am in photo 5HH and bend their knees as necessary, but neither the front knee nor the torso will extend past the toes, and the tailbone

remains pointing down.

Leaning into the ball not only means you're losing strength from the body, but your timing also suffers because your vision is impaired. Vision, and how it and only it directly relates to timing, will be introduced in either Step 6 or Step 7.

Another standard concept is to get both hand and racket face down together on a low ball.

This means you bend over at the waist, losing balance, or, if you don't bend over, your shoulder line and hip line no longer remain parallel to the ground, they tilt. Your stroke loses body support and leverage with this popular idea. A simpler way to hit a low ball will be introduced in a following Step.



A popular idea that is valid is to bend the back knee more than the front knee prior to contact, but it's merely an offspring of keeping your tailbone down. With the tailbone down, by default your back leg bends more than the front. And you'll also find your shoulder line and hip line will be parallel to the court and your torso back. Remember, you can bend your back leg more yet still lean over, lean to the side, or tilt back and lose your balance.

A simple review. Move from the center, hips and buttocks forward, tailbone down, shoulder/hip line parallel to the court, and stand up as you move to maintain vertical balance. The lower body does the work the upper body maintains form. The upper body floats above the lower body, and the torso, head, and shoulders are back, relaxed.

## FINAL POSITION & CONTACT

Prior to contact you shift your weight and establish the final position, the end result of movement and posture. To shift your body weight, you shift the center of your weight, the groin area. Your body's center (of gravity) lowers before you hit the ball, and then you inject the weight into the ball on a straight line parallel to the ground, 5I. Aggressive players will lengthen their shift (and increase power) by lengthening their stride but neither the front knee nor the torso will extend past the toes, and the tailbone points down..

As you swing, the key to not losing your foundation is:

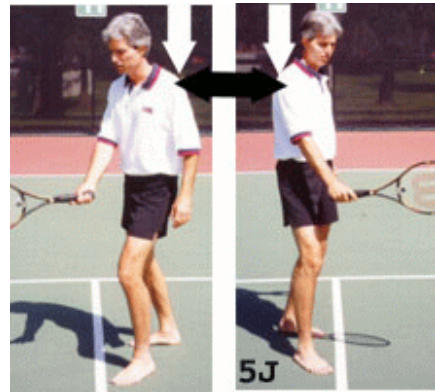


## THE BODY SHUTS DOWN

To help the swing accelerate and enjoy the most strength and support from the body, the body doesn't move. Except for the swinging arm, of course. Your front shoulder remains still up through contact, 5J, acting as a brake against the force of the stroke to accelerate it. Rotation, besides moving you away from the ball and being a complicated power source unnecessary for tennis, creates friction during the swing and slows it down.

A tennis player's contact is very close to the body, the arms don't need to fully extend away from the body like a boxer. More follows in Step 6.

If you try to shift “more” by leaning or jumping into the ball you lose your balance and thus your strength. Pros jump and twist to get more “power” into the ball, but if they remained balanced and centered they could hit even harder. I know from experience it’s hard to do because tennis is a quick game and swings are executed at breakneck speed. But since everything’s relative, the same applies to you as for the pro: keep the body calm and under control during the swing, try not to rotate to empower the hit, and snap that racket into the ball (Step 6).



## IT'S A QUESTION OF TRUST

Remember lifting the heavy box? You might not understand all the dynamics involved, but you trust the technique. The same applies here. With your body well balanced and your weight shifted properly (from the center), the arms can execute their task with the most possible strength and speed.

The objective of any swing is to generate a large burst of energy over a small period of time and space and to do it without tearing the house down with it, so to speak. The examples I use are Muhammad Ali’s “invisible” knockout punch over Sonny Liston, and Bruce Lee’s two-inch punch (or however small in length it really was). Step 6 elaborates with the Ultimate Striking Theory.

Trust the body’s strength configuration and know its limits. Martial artists do, and boxers, and dancers, and a host of other disciplines. Tennis shouldn’t be any different, it relies on, and uses, the body as well. Configure the body for maximum strength and the striking of the ball improves, no matter what your stroke is like. You might not be able to keep the ball in the court with this increased power, but later Steps involving the strokes will help you with that.

Information on strokes is starting to creep in here. How the body works and how the strokes work are two separate and distinct areas. The body has its own direction, responsibility, and obligation, and the stroke has its own separate purpose. Each must act independent of the other.

The body provides the power, the stroke provides control; the body shifts into the contact, the stroke sends the ball away from you (Step 6). When you begin to use your body correctly as a power source you will hit the ball out because your stroke has been compensating for a lack of body power. If you play twice a week, in less than 4 weeks your stroke will gladly give up its unnecessary power role to do what it needs to do, control the impact. The stroke automatically scales itself back, I’ve seen it all the time. Your instincts get the picture, that is if you move into the ball.

Golfers and baseball batters would benefit if they also separated body rotation from their swing. Just as for tennis, a golfer/batter’s body momentum must be directed into the contact spot, and nowhere else, a task made more difficult when the body rotates. A golfer or batter should direct their angular momentum (rotation) only into the contact spot and let the stroke go towards the playing field.

## LET THE STROKES BEGIN

The strokes now become the house that sits on top of your foundation. As with the walls and rooms of a house, no matter the design, the strokes follow their own structure regarding weight load and strength. Step 6 explains what is common to all tennis strokes, and later Steps will fill in the details.

### **OLD THINK**

- lean into the ball
- bend your knees to get down
- bend your back knee more
- get your hand down to the height of the ball with the racket head
- rotate the hips/shoulders during swing

### **NEW THINK**

- stay upright
- hips and shoulders parallel to the court
- tailbone points down
- lower your center, let racket reach down
- shut the body down during swing



# Revolutionary Tennis

Tennis That Makes Sense

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## Step 6

### Stroke Commonalities I: Lots Of Useful Stuff

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hit through the middle of the ball  
2 directions for 1 contact  
ultimate striking theory  
racket acceleration

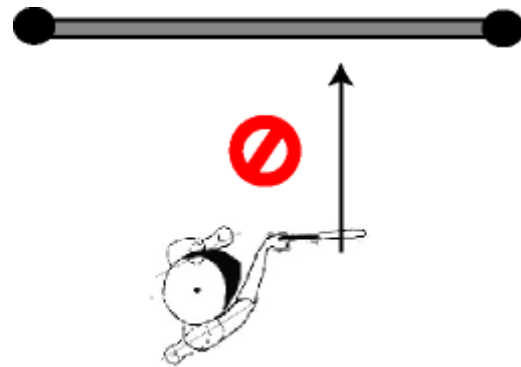
Everyone wants a faster, or quicker, stroke. Everyone wants to hit a heavy ball, hit it hard, place it well, and do it all consistently. And no one wants to work too hard to achieve these results. To enhance stroke speed with a pattern that can be repeated consistently with the least amount of work, what matters is how your arm and racket and stroke are configured the moment you strike the ball, not what your stroke looks like after you've hit the ball.

In order to form a stroke pattern mentioned above, I'm assuming you've moved into the ball with four steps (Steps 1, 2) to place the contact between the width of the feet (Step 3) and transfer power with linear momentum (Step 4) while keeping centered and balanced (Step 5).

### HIT THROUGH THE MIDDLE OF THE BALL

You've been told that hitting through the middle of the ball produces head-on contact for power and control, but the popular stroking direction in books and tennis tips produces the opposite effect.

The popular stroking direction you've seen before is an arrow either perpendicular to the net, 6A, or drawn down the middle of a street. The caption states the stroke's direction follows this arrow with the racket parallel to the net at contact, but this direction produces miss-hits.



6A Stroke direction

### IT'S SIMPLE GEOMETRY

It's true that what you learn in school becomes useful in adulthood. Especially math.

The middle of a round ball lies in a number of directions, but when it's moving the middle lies per the direction in which it's moving (center of mass in motion). Think of head-on contact between

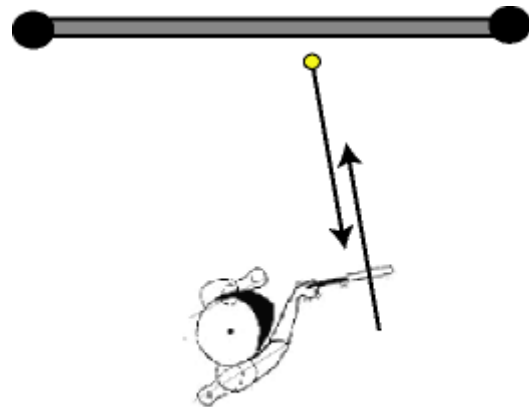
a ball and racket as two cars in a head-on collision. From one direction comes a tennis ball, from another a tennis racket face, and they both impact head-on, or squarely.

A tennis ball moves on an angle across the court, Step 1. Hitting through the middle of a tennis ball, then, means a stroke direction against, or into, the ball's incoming angle.

Let's transfer this image to a 2 dimensional bird's eye view used before, 6B. The stroke's direction through the middle of the ball is to be drawn per the ball's flight line, not perpendicular to the net.

To ensure head-on contact, the racket face forms a right angle at contact to the ball's flight line. In 3 dimensions you have topspin and slice, but they too hit head-on with either an open or closed racket face for solid contact.

Swinging straight to and/or keeping the racket face parallel to the net doesn't place the ball and racket in a head-on collision. Your stroke is unsupported and weaker with this popular idea.



Stroke direction through the middle of the ball  
6B

## 2 DIRECTIONS FOR 1 CONTACT

You may have figured this out on your own, what I think could be the most meaningful secret to the game. When you shift your weight linearly into the contact spot, Step 4, and the stroke pattern heads through the middle of the ball toward the opponent's side of the court, 6B, 2 distinct directions are involved. Diagram 6C combines these 2 directions.

You shift your weight into the contact spot, into the ball; the stroke heads through the middle of the ball toward your opponent. 2 directions for each contact.



2 directions for 1 contact  
6C

Your body shifts weight for power in tennis using linear momentum, not angular momentum (rotating the hips/shoulders), Step 4. You shift linearly into the ball and not "linearly" with the ball's flight to the opponent's court.

Now the example of hitting a ball on-the-run comes into sharper focus. 2 clear and distinct directions are involved for body and stroke hitting on-the-run moving either forward into the court or off the side. The empowerment structure (body) heads into the ball/contact, and the delivery structure (stroke) heads towards the other side of the net.

I'm aware that the body's extra momentum when hitting on-the-run covers up a host of sins. But I believe extreme examples often provide insight, as this example has for movement, footwork, contact zone, and power delivery methods in earlier Steps. After all, when you start a rally by bouncing and stepping into the ball, you're enacting 2 direction for 1 contact, on a slower basis.

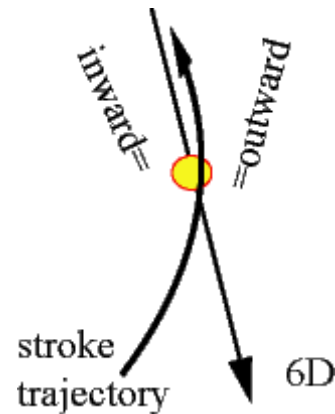


## WHAT ABOUT BODY ROTATION DURING THE SWING?

The swing has the potential of ruining the body's foundation and support, Step 5. Its angular momentum and acceleration can pull the body away from the ball prior to and during contact because it heads in a direction separate from the body's focus (into the ball/contact).

The swing's trajectory is basically an arc that stems from a common origin (shoulder). Arcs accelerate in a direction inward from the trajectory, that is inward from the contact spot, 6D, which is why 6B's head-on stroking direction feels solid and strong. This sends the ball back in the same direction, often more to that one side.

There are times when you send the ball outward from the contact spot. Here the shot is weaker and the risk of losing control is greater: hitting inside-out, changing the ball's direction (though [Step 7](#) explains when changing the ball's direction plays to the stroke's strength), or responding to a sharply crosscourt ball (unless you hit it even more sharply crosscourt). Generally speaking, hit your best shot, through the middle of the ball. If you choose not to, understand the risk involved and don't go all out.



If the body rotates after the contact it's okay. This happens, the body doesn't remain still like a statue, the stroke pulls at you. However, if the body rotates during the swing, during contact as part of the swing for power, both power and control are sacrificed. You need to separate the empowerment structure from the delivery structure.

## ULTIMATE STRIKING THEORY

The ultimate striking theory is simply understood. Boxers and martial artists train to generate a large burst of energy over a small period of time and space. No large, looping, roundhouse punches for these athletes, but short, compact, deep, effective strikes. Quick. Heavy.

Earlier I've used the example of Muhammad Ali's "invisible" knockout punch over Sonny Liston, and Bruce Lee's two-inch punch (or however small in length it really was). By the same token, you don't need a large bomb to deliver the biggest of bangs anymore.

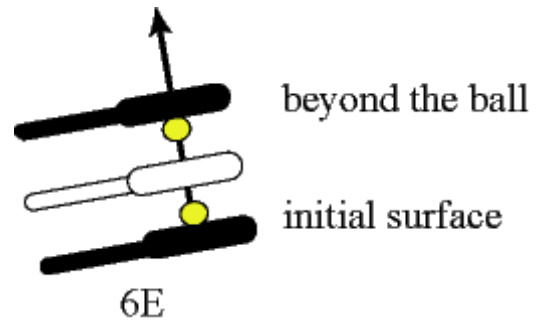
The ultimate strike is not of great length, and its force extends beyond its target. Ball placement has always been considered the target in tennis, but it's the second target, if not the objective. The first and primary target is and has always been the ball at contact. A tennis player focuses everything s/he does into the contact, footwork, power, vision, stroke, and then places the ball.

## BEYOND THE BALL

I haven't personally broken any bricks or boards with my hands, but martial artists say they focus not on the top surface of the board but beyond it, past it. When breaking through cinder blocks stacked on top of one another, the athlete focuses on a point beyond the last block.

Furthermore, a martial artist focuses on the forward strike's acceleration, creating a burst of energy to break the blocks.

You are about to strike a tennis ball with the racket strings. What will your strings focus on, the ball's surface facing you? Focus beyond the ball, past the ball, on the side away from you, 6E. Do you take that racket really far back to increase your power? No need to, just take it back quietly. When you swing, will it be a long swing for more oomph? No need to, just a burst of energy into the ball.



A popular tennis idea wants you to hit through three tennis balls instead of one to hit “through” the ball. This image still has you focusing on the ball's surface facing you. Instead, focus beyond the ball for greater effect.

## RACKET ACCELERATION

Step 5 said: “To help the swing accelerate and enjoy the most strength and support from the body, the body doesn't move. Except for the swinging arm, of course. Your front shoulder remains still up through contact, 5J, acting as a brake against the force of the stroke to accelerate it. Rotation, besides moving you away from the ball and being a complicated power source unnecessary for tennis, creates friction during the swing and slows it down.

Now we'll add up what we've learned here in Step 6. A stroke's acceleration lies in a direction inward from the contact spot, 6D, and is greatest when there is a common origin, our shoulder and then elbow, in our case. [Extend your arm straight away from your body, keep your shoulder still, and swing the arm side to side. Next, move your shoulder side to side and swing the arm. Compare the two speeds. When the common point, the shoulder, is still, the arm accelerates more. Furthermore, the arm pivots around this common point.]

When you swing the racket and move the shoulder(s) around you lose acceleration because the common point moves. The same happens when you shift your weight along the flight line of the ball, or when you rotate, the common point moves. I've said it before, and I'll say it again: Rotation for tennis players is counterproductive to success.

## DON'T BE A STROKE GUZZLER

Don't be a stroke guzzler. The idea is not to waste a natural resource, the arm, like an inefficient automobile engine wastes gasoline. You become a stroke guzzler when the arm moves too much as a whole, or when the arm is engaged as one unit or doesn't flex during the swing.

Let's use the same example above where you extended the arm straight away from you and moved it side to side keeping the shoulder still. Do it again and notice the speed at which your hand moves. Stop, then bring the elbow in to touch your stomach and move only the forearm side to side. The hand moves faster, doesn't it?

During a tennis stroke the shoulder is the first common point but you can't swing the racket with your arm completely extended or straight and expect good results. It's too slow, plus there's no leverage with the arm this way. You don't pick up a box with your arms straight, do you?

The elbow, then, becomes a second common point, or pivot point, during your swing. As you

begin your forward swing the arm bends to pivot at the elbow, bringing the elbow in closer to the side of your body, and the biceps slows down. Here the shoulder relinquishes its role as the common point and passes the torch to the elbow, whose deceleration helps the racket accelerate more. On forehands the elbows passes the torch to the wrist, but not on backhands.

### MORE ACCELERATION

All in all the arm's parts compress into the body (to reduce their moments of inertia to increase the stroke's angular momentum) in an effort to whip the racket face around the arm and the body as fast as possible to hit the ball head-on. In a not so small way, this is similar to an ice skater spinning in a circle with her arms extended who then brings them in to spin faster. Of course we don't spin around, but for the small moment of a forward swing, the arms come in closer to the body to increase our racket's forward acceleration.

6F, left photo, shows the arm extended with the racket back. 6F top photo shows the arm coming in closer to the body during the forward swing for leverage dynamics, what you want. 6F bottom shows what to avoid, the arm extending away from your body laterally during the forward swing. 6G shows the arm folded, then unfolded during the swing for backhands in order to maintain leverage dynamics, you don't want to swing the arm straight out away from you. It's the same for two handed backhands, even though there are styles where the arms straighten and the wrists (not the elbows) act as the pivot points.



### WHAT ABOUT THE PROS?



Photo 6H, left, shows the arm placement a pro often uses when taking the racket back on the forehand. The elbow is up high, the arm is drawn back in exaggerated form, the body's coiling, the stance is open. But they, too, from this position, must adhere to the arm's leverage dynamics. If they don't, and a lot of them don't, their forehands aren't what they want them to be. The exaggerated use of the arm during a pro's swing is a symptom of inefficiency, much like low gas mileage for a large automobile engine.

The 6H photo on the right shows adherence to the arm's leverage dynamic: the elbow drops and the arm comes in closer to the body for leverage and speed, and will resemble 6F top photo right during the forward swing. Though some pros extend laterally on their forehands, it's definitely more the exception than the rule. On forehands you have to get closer to the ball than you're used to because stretching, or extending, equals leverage loss. And on backhands you have to resist straightening the arm as part of the stroke's objective because that, too, equals leverage loss.

## **A SIMPLE TENNIS QUIZ**

Now for my simple tennis quiz. What hits the ball? Quickly, answer. It's not the racket, it's the racket's face, or strings. Keep this in mind.

What part of your body swings the racket? Answers have been shoulder, arm, chest, body. Well, the racket is not connected to any of those points. The shoulder doesn't swing the racket any more than the arm. The hand does.

Your hand, then, swings what to hit the ball? The racket? No, that doesn't hit the ball. The hand swings... the strings. Okay, end of quiz.

Many popular stroking ideas inhibit acceleration, such as extending the arm out away from your body, straightening the arm for the contact, reaching out to the side, swinging from the shoulder. My favorite is swinging the arm to swing the racket, which is the cart pushing the horse.

The arm is bent at contact, never straight, even on backhands. It straightens momentarily after contact, like it does the moment after your throw a ball. The arm doesn't straighten for an effective swing any more than it straightens to throw a ball. On backhands the arm is folded across the stomach, unfolds during the swing, and is bent after contact.

The hand flexes at the wrist on forehands. There's a natural spring to the wrist on a forehand, a bit of a throwing motion, and it becomes the last common point after the elbow to help accelerate the racket head into the ball. The wrist is to be used, not abused, it doesn't flop or break as on serves and overheads. Wristy is the wrong way to describe using the natural spring the wrist provides, and without it the forehand doesn't mature.

A popular idea it to keep the wrist stiff on a forehand to commit fewer errors. While there is literal truth to that reasoning, this kind of forehand isn't a weapon and leads to arm or shoulder injury since you're denying the natural spring of the wrist.

Part II follows in Step 7

## **OLD THINK**

## **NEW THINK**

### **To Hit Through The Middle Of The Ball**

- swing straight to the net
- racket face parallel to net
- swing INTO the ball's flight line
- racket face at a right angle to ball's flight line

### **Racket Acceleration**

- large backswing
- shoulder swings the racket
- swing away from the body
- swing to the net
- hit the ball hard
- long strokes accelerate more
- the body's larger muscle groups rotate to accelerate the swing more
- large backswing is not needed
- hands swings the racket
- arm gets closer to the body
- swing head-on into the ball
- focus beyond the ball
- acceleration is a burst of speed, not length
- 2 directions for 1 contact



## Step 7

### Stroke Commonalities II: More Useful Stuff

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#### VISION

Timing. How and when do you time your swing to hit the ball? Do you tell yourself to “swing” or does something inside you pull the trigger, even when you hit late? Your instincts pull the trigger, and they do so based on the information your brain gets from your eyes.

How well you see determines how well you judge things. If your eyes see the ball clearly in 3 dimensions, if you reference correctly where the contact spot must lie, and if your head remains still prior to and during contact you’ll hit the ball on time.

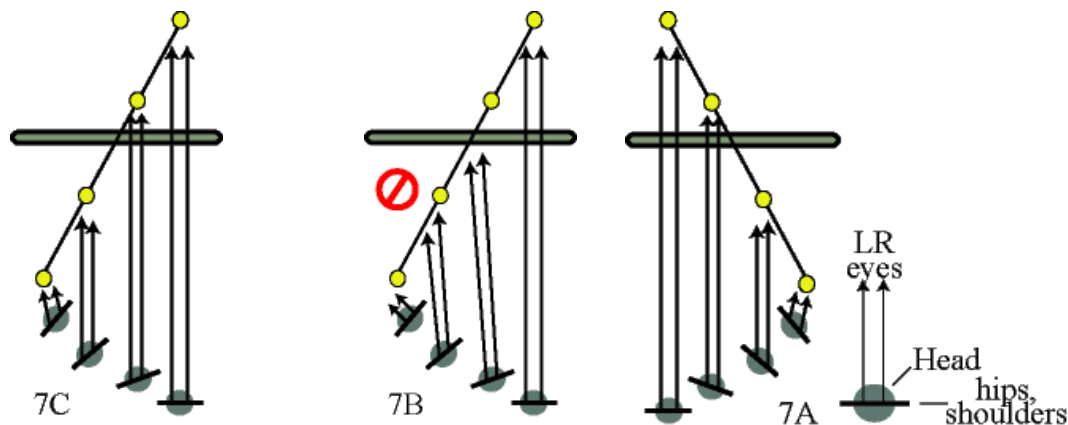
This is all a very tall order. “Watch the ball” is a popular idea, and it is 100% right-on. Watching the ball well not only leads to perfect timing, it leads to enhanced mental concentration. But how do you watch the ball well, and how can you fix things when your timing - your vision - is off?

#### SEE IN 3-D

Both eyes must see the ball head-on to see it clearly in 3 dimensions. Sure, you can see the ball with your peripheral vision, but your two eyes and your nose must point straight at the ball as they’re pointing now at your computer screen or the information your brain receives about the ball’s flight won’t be 100% accurate. With the right information your instincts cause you to swing on time, with faulty information your stroke fires at the wrong time.

It’s hard to catch a ball thrown at you if your head is turned sideways to it. It’s harder yet to hit a moving object with your eyes sideways to it. As an example, turn your head away from the computer screen a little bit and close the eye closest to the screen. Your other eye sees the bridge of your nose, right? With both eyes open you could still read with your head turned slightly to one side, but it would get to you. Keep this in mind for the following.

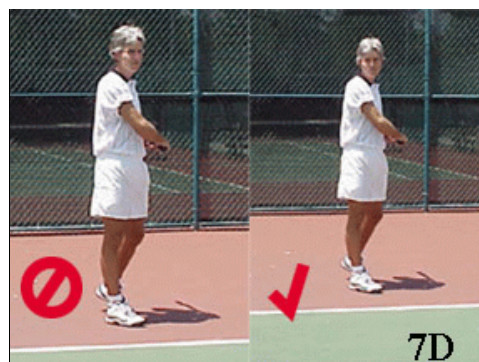
Diagram 7A shows your eyes tracking the ball during the often successful forehand. The eyes on the first image of the head see the ball head-on and clearly in 3 dimensions. The subsequent images show that as your shoulders and hips turn as a result of moving into the ball, your head counter-turns to keep both eyes directly on the ball. (For simplicity, one line represents both hips and shoulders, though, as diagram 4G shows, the shoulders can turn more.)



This counter-turn for vision adjustment doesn't occur as easily for backhands because the racket arm pulls across your body when taking the racket back. As a result, your head is turned too much to the side, 7B, and while you see the ball, the bridge of your nose impedes your back eye's look at the ball. You don't see clearly in 3-D without the back eye balancing the ball's image. With the front eye's image dominating, you see the ball too far out in front and will swing too soon. Bad timing. The ball goes sharply to your right.

To help your backhand's timing, see the ball better by counter-turning more than what feels comfortable. You have to work at this to keep both eyes clearly on the ball at contact, 7C. Open your face toward the net to allow your back eye an unimpaired view of the ball during its flight.

Photo 7D is taken from a crosscourt ball's point of view heading to my backhand. Both of my eyes can see the ball in the photo on the right, my face is "open" to see the ball clearly. My face is turned too much to the side away from the ball in the photo on the left, toward the net post, and my back eye can't see the ball clearly at all.



The back eye is the most important of the two eyes. It balances the depth of the ball coming by you. Together with the front eye a composite picture in 3 dimensions is created.

Turning sideways forces you to counter-turn your head even more to see the ball clearly. Ouch. Another situation where turning sideways is counterproductive to performance.

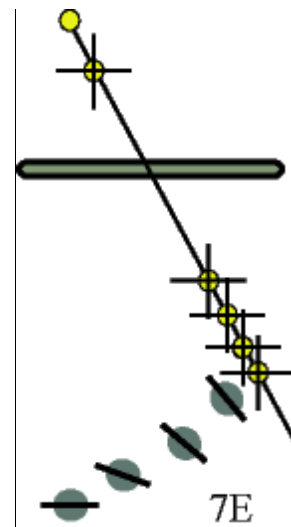
### REFERENCE THE CONTACT SPOT

Your eyes don't see every moment of the ball during its flight as smoothly as a movie camera panning the horizon. Scan the wall ahead of you and notice a curious effect. Your eyes track the wall points at a time - each point is a reference point - and your brain puts them together for you.

You need to reference a specific point, or moment in time, in which to hit the ball. This moment is often more out in front of you along the ball's flight line than you're aware of. Hence the term "hit out in front."



Diagram 7E shows a ball in flight and how your eyes track the ball. Each ball image is a reference point in time and space. If you reference the last ball in 7E's sequence as your contact spot you'll be late. The one ahead of the last one is the "correct" one, typically farther ahead along the ball's flight line. This applies for backhands and all other strokes.



Your eyes see the ball in different points in time, like an image in a strobe light. You can't swing when the ball's at the right reference point in time because it'll take too long for you racket to get to it. You have to swing before the ball reaches that correct reference point in time.

It's easy to time the ball when it's slow, but when it's faster you need a more sophisticated method. To hit on time your eyes will jump from where the ball is in flight to the correct reference point a fraction of a second before the ball actually reaches it. In that fraction of a second your stroke fires and hopefully contact is made at the right moment in time.

In 7E there are four ball images on your side of the net, with number 1 being the one farthest from you and closest to the net, number four being the one closest to you. Your reference point for perfect timing is number 3 (matching diagram 7A). Your eyes will jump from ball image number 2 to the empty space it will soon occupy as image number 3. Your stroke fires when you're looking at reference point number 3. The racket face, and ball, and reference point, hopefully become one. Your head doesn't move when referencing the ball, only your eyes move, jumping ahead in time.

This is difficult to do, to say the least, but more easily achieved on your forehand because your face is never potentially as turned to the side as on your backhand and your head seems to remain still better during the forward swing. Pros need to reference the contact spot too, it's too impossible to literally see the ball into your strings, and when the ball's too fast to mark the reference spot, muscle-memory and adjustments fill in the gaps.

## ADJUST YOUR TIMING

Miss-hits are often caused by poor, or incorrect, vision, as well as a lack of head-on contact with the ball (Step 6). You move well, you swing well, but there are some (or many) days when the contact isn't solid, the ball doesn't travel well. You're not seeing the ball clearly. The first solution is simply to keep your head steady during the swing. But sometimes real tweaking is necessary to resurrect your timing.

Let's say you're hitting late on your forehand. This simply means you're turning your head to the side too much before stroking, you're watching the ball go by you essentially. To correct this stop the extra lateral head tracking movement and insist on a reference point farther ahead. Keep the back eye facing forward more. Some days you'll have to force yourself to swing, on others your instincts will readjust. Good forehands are hit earlier than expected.

It's rare that you hit the forehand too early, but if you do, you're not tracking the ball laterally

enough. Your face literally isn't moving to the side a little bit.

Ironically, a backhand hit too early means your head is turned too much to the side from the very beginning. Here your vision's impaired (7B) and you'll hit too soon. You need to open up your face and reference the contact spot sooner. In the minority of cases hitting a backhand too early means you're not tracking the ball long enough into your stroke. And if you're hitting late, like on the forehand above, you're watching it go by you.

### **BUT DO YOU REALLY HAVE TO LOOK AT THE BALL?**

A charismatic tennis teacher with a tennis college insists you shouldn't waste your time trying to look at the ball during contact. He states the human eye is incapable of seeing the ball strike the strings because it happens so fast, and that large numbers of photos with the pros' eyes looking not at the ball at contact but elsewhere is evidence you shouldn't bother.

A common sense response is that the photos with the pros' eyes not on the ball at contact serves notice how hard it is to do. I assure you pros are trying their hardest to look at the ball while hitting it. And aren't photos with the pros' eyes on the ball at contact evidence you should?

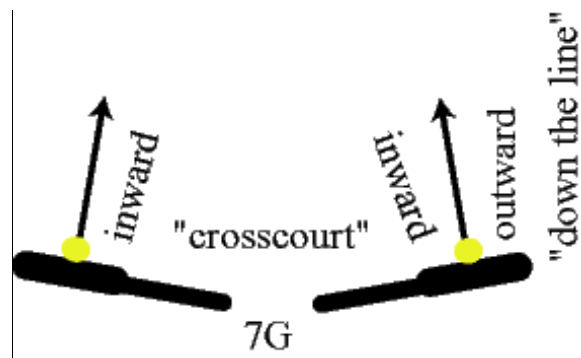
Of course you watch the ball until your racket strikes it. You don't see the ball on the strings as clearly as a high speed photograph captures the image, that's for sure, but you see a blur, an event, if you've referenced the contact spot accurately. It's not easy to line it all up, but it helps to look at the ball.

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### **BALL PLACEMENT**

The popular tennis ideas of hitting crosscourt or down-the-line depend on which side of the court you're on, as opposed to the direction of the strength of the stroke and whether or not you get to the ball on time. These popular ideas fracture your concentration and promote selecting what often is the stroke's weakest shot.

**Revolutionary Tennis** proposes there are two directions the ball can go when it leaves your racket face, either to the left of the contact spot or to the right, 7G. Step 6 shows how the strokes' strength lies inward from the contact spot, 6D, as an arc to a (the ball's) tangent, and that head-on contact creates a right angle against the ball's flight line, 6B. For want of a better term, this direction inward from the contact spot I'll call crosscourt.



If you hit late, or if the racket face is parallel to the net at contact, the ball heads outward from the contact spot. The contact here is weaker, and for want of a better term, I'll call it down-the-line. If you're right handed in the middle of the court, your forehand goes crosscourt to your left, to the left of the contact spot. A down-the-line goes to your right, to the right of your contact spot. The opposite works for the backhand: crosscourt to the right, down-the-line to the left. In other words, ball placement direction is stated simply as:

## THE STROKE ON YOUR RIGHT SIDE

|               |                                  |
|---------------|----------------------------------|
|               | the ball goes                    |
| Crosscourt    | to the LEFT of the contact spot  |
| Down-The-Line | to the RIGHT of the contact spot |

## THE STROKE ON YOUR LEFT SIDE

|               |                                  |
|---------------|----------------------------------|
|               | the ball goes                    |
| Crosscourt    | to the RIGHT of the contact spot |
| Down-The-Line | to the LEFT of the contact spot  |

I know you're saying, "Wait a minute, that's not what I hear on t.v. or read in magazines." Hold on, I'll explain.

A common theme in **Revolutionary Tennis** is to look at the game from the ball's point of view, the racket's point of view, and the body's point of view. It's no different here but the popular idea is that crosscourt means the open court and down-the-line means the nearest sideline. This creates a contradiction.

## POPULAR PLACEMENT IDEAS

### THE STROKE ON YOUR RIGHT SIDE

| When in the   | DEUCE COURT                      | in the | AD COURT                         |
|---------------|----------------------------------|--------|----------------------------------|
|               | the ball goes                    |        |                                  |
| Crosscourt    | to the LEFT of the contact spot  |        | to the RIGHT of the contact spot |
| Down-The-Line | to the RIGHT of the contact spot |        | to the LEFT of the contact spot  |

### THE STROKE ON YOUR LEFT SIDE

| When in the   | DEUCE COURT                      | in the | AD COURT                         |
|---------------|----------------------------------|--------|----------------------------------|
|               | the ball goes                    |        |                                  |
| Crosscourt    | to the LEFT of the contact spot  |        | to the RIGHT of the contact spot |
| Down-The-Line | to the RIGHT of the contact spot |        | to the LEFT of the contact spot  |

If you notice, one direction is called crosscourt on one side of the court but it's called down-the-line on the other side of the court. On the deuce side the ball leaves the racket face going to the left of the contact spot and it's called crosscourt, but on the ad side it's considered the same "direction" when it goes to the right of the contact spot. Contradictory and confusing. Something more to think about has been added to your game.

## TAKE YOUR BEST SHOT

Go with your stroke's strength per your timing with the ball. Go with your best shot or you're compromising the hit. You need to concentrate on the hitting, not on variables that will detract from that focus. Don't evaluate which side of the court you're on before deciding on crosscourt or down-the-line; don't take the time to figure out where the open court lies, or in which direction your opponent's backhand lies; don't worry about hitting behind the opponent or into the open court. Keep it simple. Elegant.

Basically speaking, when you get to the ball on time you hit crosscourt, when late you hit down-the-line. This generally translates into hitting crosscourt when you're closer to the middle of the

court than the sideline, and down-the-line when you're closer to the sideline than the middle. These directions are per the ball's and racket's point of view.

Take your best shot, always, even if your opponent stays right where you want to hit it. Your shot is compromised when you try to hit against the stroke's strength, your shot is weaker when you try to hit down-the-line when it should have gone crosscourt or when you insist on NOT changing the ball's direction. Yet this happens all the time.

I used to serve and volley. I'd rush the net, and while preparing for my volley I'd evaluate should I hit it to, A) his weak side, B) to the open court, or C) behind him. Too much to think about.

All I needed to do was evaluate whether or not I was on time with the ball. If I was, bang, crosscourt. If late, bip, down-the-line. These directions were connected with my stroke and the ball, not with the court itself, and with less to evaluate my mind was freer to focus on the ball.

## **REAL-TIME SITUATIONS**

### **Serve And Volley**

Serve into the forehand or backhand corner, Deuce or Ad court.

Return goes to your right. You're close to the center, you're not stretched out. This means you're getting to the ball on time. Hit crosscourt. Or you're stretched out, late, and now closer to your sideline than the center line. Bip, down-the-line.

Return goes to your left. You're on time, closer to your center line. Crosscourt. Or you're late, stretched out, reaching. Down-the-line.

Before I go on, I advocate taking your best shot. This might result in hitting right back at your opponent, but s/he'll won't handle your best return well enough to hurt you. If they get it back, you win with the second volley. Volleying down-the-line will keep you in the point for a second shot, whereas if you tried pulling this shot crosscourt your volley won't be effective enough and it's harder to get ready for the next volley.

Mistakes are made in hitting crosscourt when you should have hit down-the-line, or vice versa. Don't try to pull the ball crosscourt when it doesn't go to your stroke's strength, don't invert the ball down-the-line when the strength lies crosscourt.

### **Returns (righties only)**

Ball goes into your FOREHAND corner. You're on time, go crosscourt. In the deuce court the ball goes to your left, across the court. In the Ad court it also goes to your left, it stays on the same side you're on.

When late hit down-the-line. In the Deuce court it's down the sideline, often a winner or to elicit a weak return. In the Ad court this shot goes "inside out."

Ball goes into your BACKHAND corner. You're on time, crosscourt, to the right of the contact spot. In the Deuce court it's down the nearest sideline, often to an opponent's backhand. In the

Ad court, it's across the court.

When late, down-the-line. In the Deuce court, it's "inside out." In the AD court, it's down the nearest sideline.

When you're late getting to the ball served down the middle of the court you're sending the ball down-the-line, "inside out," which in this case happens to be the stroke's strongest choice.

I think you get the picture by now. When you're trading crosscourt shots and you choose to hit down-the-line, unless it's good enough (less than one racket length from the sideline) your opponent will be on it before you've repositioned to the other side of the center mark. It's risky.

### **TO CHANGE OR NOT TO CHANGE THE BALL'S DIRECTION**

Ball placement isn't about not changing the ball's direction. "Don't change the ball's direction" is an apparent axiom in tennis, it means hit the ball back where it came from. Yet this popular idea also asks you to evaluate a variable that has nothing to do with your stroke's strength and making it harder to concentrate.

If your stroke's strength means you need to change the ball's direction, do so. This happens in only a couple of scenarios, and in reality you're hitting the ball more (naturally) crosscourt instead of literally right back where it came from (by restricting the stroke).

### **EXAMPLE**

Your opponent hits a ball to your backhand corner. You run around your backhand to hit an inside out forehand back to his/her backhand, thus not changing the ball's direction, hitting it back where it came from. If you're on time here and go with your stroke's strength, the ball goes to the inside of the contact spot, crosscourt. This sends the ball down your backhand sideline, but the distance in this direction is less than down-the-line (inside out), the net higher, the repositioning requirement more demanding, and if the shot isn't within one racket length of the sideline you're in trouble.

Players hit "inside out" because there's too small a window to go crosscourt, and they want to avoid their backhand. But if you're standing not so far over in your own backhand corner, if you're halfway between your corner and the middle hashmark, there's enough room to go crosscourt.

Let's say you rush the Ad court and hit a forehand volley crosscourt when you're on time and closer to the center line than the sideline. This "changes" the ball's direction, you're not volleying back where the ball came from, but it goes with the stroke's strength. Same when rushing the deuce court and hitting a backhand volley when you're on time.

What "don't change the ball's direction" really means is don't pull the ball crosscourt when you should have gone down-the-line, don't pause to go down-the-line when you should have gone crosscourt. This sounds familiar. Go with the stroke's strength and improve your concentration by not cluttering your mind.

## BREAK THE RULES..?

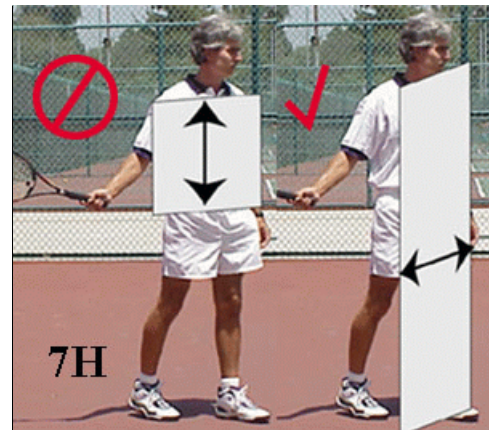
When you know the rules and work with them comfortably, you can break them because you'll prepare to compensate for the stroke's added instability in doing so. You won't try to hit it too hard or go for too much, you'll place the ball because the shot's weaker by definition and you'll get ready for a return.

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## THE CONTACT ZONE

The contact zone has always been described as located between the hips and the shoulders, 7H, left, which is similar in concept to baseball's strike zone for a batter. But in tennis you can hit the ball well when it's lower than your hips or higher than your shoulders, and you can't let one go by because it's out of your strike zone.

Step 3 illustrated your body's power zone, that is contact takes place between the width of identically placed feet. Instead of looking at the contact zone for tennis as an area that has just a certain height to it (between hips and shoulders), you should look at the contact zone as an area with a certain width to it (between the width of your feet). This creates a vertical plane, and takes into account striking the ball at whatever height, 7H, right.



Height is secondary the contact's placement between the width of the feet, and it's the same for baseball. It's not the height that counts, it's where the contact lies between the width of the feet. Contact too far ahead in this zone and you're too soon, too deep in the zone and you're late, no matter the height.

Contact is often stated as hitting out in front. Step 3 illustrates this does not mean in front of your foot, or ahead of you. It simply means out in front along the ball's flight line, hitting sooner rather than later.



Contact is often stated as extending your arm away from your body laterally, or extending it toward the net, during the contact. Your arm leverages your body's power into the ball, and adheres to leverage mechanics. As such your arm is always bent, and closer to your body in every direction rather than extended during contact, 7HH. If you reach out to the side, or reach out in front of you, the arm straightens and loses leverage. Ouch

The arm almost throws the racket at the ball. As such, it flexes, it is never rigid. You'd never throw a ball with your entire arm locked in one place. As seen in Racket Acceleration, the wrist flexes forward to deliver the racket into the ball on your forehand groundstroke, but not on your backhand. The wrist needs to be locked on the backhand (and volleys), though it easily breaks



backwards before or during the hit because it's the point of least resistance.

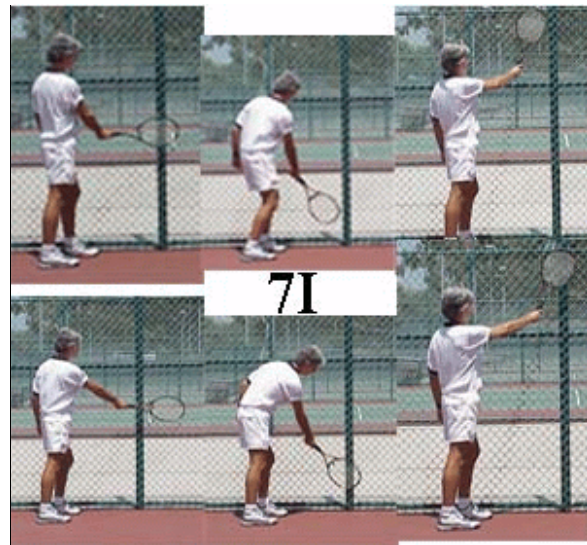
### **HIGH BALL = LOW BALL LEVERAGE DYNAMICS**

The popular idea on high balls is to extend and straighten the arm farther away from the body for contact. A popular southern tennis teacher says you'll have more strength this way and not when you're closer to the ball. Fuzzballs.

I'm using the fence pole in photo 7I, top left, to show how far away the ball is from my navel when the ball's waist-high. The pole represents X distance horizontally from my navel, the fence itself is "out in front," and the ball's waist high. I urge you to try these examples and show yourself which position provides greater strength.

You're familiar with hitting the low ball easily, but not the high one. Their realities are one and the same. Let's look at what you're doing correctly on the low ball.

It feels good when you hit a low ball because the arm works properly as a leveraging device. Photo 7I, top row, middle, and right, shows low-ball contact and high-ball contact respectively. My racket face doesn't reach the fence post in either scenario, which means the contact is closer to my body horizontally than it was when the ball was comfortably waist-high. Contact for the low-ball is NOT the same distance horizontally from my navel as with the waist-high ball, it's CLOSER in order to maintain leverage with the arm. The same for a high ball.



7I, bottom row, shows the curious effect of extending out to the ball. 7I, bottom left, shows my arm extended out past the post for a waist high ball, a popular idea. Here leverage is lost. 7I, bottom middle, and right, shows me reaching out to the pole itself for either low or high ball, maintaining the same horizontal relationship to my body as when the ball was comfortably waist high in 7I top left. Here my posture is compromised and my leverage/strength suffers.



7J offers the high backhand that bothers us all. The top row shows the same leverage relationship with the body and contact as in 7I above, and the bottom row shows the configuration for leverage loss, extending the arm away from the body. Compare these positions for yourself to see where and how your arm feels stronger. I bet you'll find it's stronger when it's closer to you rather than extended away from you. The high ball's contact is exactly the same as for the low ball, the arm comes in closer to the body for greater arm strength, it is not the same distance horizontally from your navel as when it's comfortably waist high. Now why don't we do this?



Beats me. Maybe you'll be too strong and won't be able to control it. But I know one answer is that by straightening the arm on the backhand you get to "swing" more and feel like you're getting more, though the lack of leverage here means you're a stroke guzzler.

These leverage dynamics for groundstrokes also apply to low and high volleys. Getting down to the low volley in traditional form leaves your arm in a weakened position. A later Step will explain further.

### THAT'S IT

I could stop here and not explain much else regarding the strokes, but I'll continue because I know you're caught up in them. Consider this. If you move into the ball well, if you take your racket back any old way but then compress the arm for the forward swing, if your racket face hits the flight line of the ball head-on and your reference the ball on time, and if you hold yourself during the hit to prevent rotation from adversely impacting the quality of your stroke, I'd bet you'd have one heck of a shot.

Some of the particulars of a stroke are immaterial as long as you hit the ball on time and don't experience injury. What matters is how you move, your balance, how well you see the ball, stroke preparation, and what you're doing at and only at contact. You're hitting the ball, remember, and toward somewhere with a certain amount of spin and lift. Of course a lot of this can go out the window if, instead, you focus on following-through in A particular manner, as in wrapping your stroke around your shoulder so you could listen to the ticking of your wrist watch if you had one on your racket hand.. As my girlfriend said, you're not hitting the follow-through.

There are many stroke styles, as there are house designs, but they all adhere to the structural concepts of the arm and shoulder for leverage and strength much like a round or square room adheres to structural concepts for load bearing and support. In the pros some strokes are more solid than others and produce results with less effort and work, while others lead to inconsistencies and injuries. I will describe strokes that are efficient, that require the least amount of effort. These strokes are also known as compact strokes. You'll be able to achieve this coveted stroking style because your body will be supporting you 100% due to the ideas proposed

here in **Revolutionary Tennis**.

I'm going to take a little break to consider how I want to present the groundstrokes, volleys, returns, serve, and whatever else. I'll see you in the fall sometime. Thanks for your e-mails. I like the feedback, and it helps me reevaluate and clarify what I've written when there are fuzzy areas. Thanks.

## **OLD THINK**

## **NEW THINK**

### **Vision**

- watch the ball
- keep both eyes on the ball
- open your face to see better
- reference the contact spot

### **Ball Placement**

- don't change the direction of the ball
- go with your stroke's strength
- hit into the open court
- hit behind the opponent
- hit to opponent's weakness

### **Contact and Leverage**

- extend arms for contact
- keep contact closer to the body
- extend arms on high balls for more power
- closer to the ball laterally on high balls

# Revolutionary Tennis

## Tennis Instruction That Makes Sense

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### Step 8

## The Forehand Groundstroke

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mark@revolutionarytennis.com

A lot about "the forehand stroke" has to do with traditional footwork, body usage, and weight distribution methods that preceding Steps outlined as counterproductive to efficiency and results. Instead, by moving naturally, moving into the ball, shifting your weight into the contact spot and eliminating body rotation, your forehand will feel and play better no matter what your stroke looks like.

But something is missing from all the tennis literature on the subject. That something is the natural use of the arm's leveraging ability during the forward swing. That something maximizes the stroke's acceleration. That something I call The Neat Stuff.

I'm going to assume you already know about "how" to hit a forehand, that is you're familiar with the grips, Bollettieri's "Killer" forehand, Tennis magazine's breakdown of various pros' forehands, and various other ideas proffered by old and young alike.

To refresh, you have the loop backswing and take the elbow back. The open stance. The great winding, or loading, of the shoulders and hips. The great unwinding of same allegedly for power and stroke acceleration. The weight transfer toward the opponent. The major wrap around the neck for the follow through. Finishing with hips and shoulders facing the net or with either the back shoulder or the back leg or both out forward into the court more than their counterpart. And it's been like this since day 1 for tennis, some hundreds of years ago.

Yawn.

I believe Bill Tilden's forehand is no different in its structural use of the arm than Andre Agassi's, only that Andre does everything a lot faster. After all, Mark McGwire's use of his arms on his swing isn't different than Babe Ruth's, and Tiger Woods' use of his anatomy is not any different than Ben Hogan's. Today's athletes, it can be argued, simply do things a little faster and for more duration, but the structural use of the body, specifically the use of the arm, doesn't change because it can't. If it did, we'd either have tons of injuries or we'd be witnessing a new evolutionary stage in human development. Baseball pitchers have tweaked their delivery a bit to help reduce rotator cuff injuries, but for the most part the throwing motion remains the same.

### **PLEASE REMEMBER**

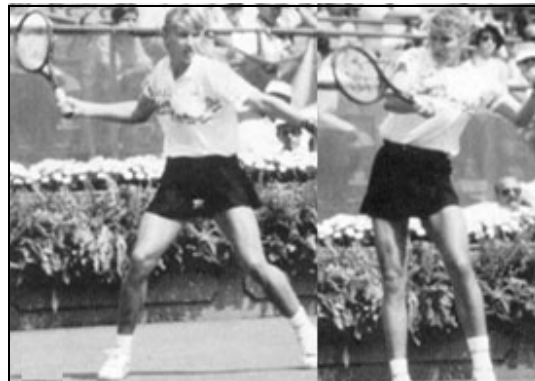
Earlier Steps placed you moving forward into the ball in an attempt to hit the ball off the front foot with good body balance and little, if any, rotary movement from the body to accelerate the stroke. Revolutionary tennis advocates that by using your body's linear momentum as your power

source instead of angular momentum your tennis racket can accelerate best in terms of speed and contact value. If you don't accelerate the racket into the ball, "power" isn't realized, no matter how good your movement, structure, and weight shift; if the acceleration isn't controlled, accuracy is lost.

And if you're an advanced player your torso turns a little bit more than your lower body when preparing the stroke and moving into the ball, and then re-turns to match it during the forward swing and into contact. At the end of your routine your objective is not to face the net with either hips or shoulders - if you do 'cause you swung so dang hard that's one thing, but if you incorporate that as part of your swing you're overdoing things and will lose control.

## THE PROBLEM

There's a problem in seeing how the arm works on a forehand because the arm looks the same when the racket's back and when the racket's hitting the ball. When the racket's back the arm is in a crooked position, at times the elbow lies behind the hand and forearm. And at contact it looks the same, the elbow is behind the hand and forearm. The photos of Stan Smith and Steffi Graf bear this out. (Stan's photo by Fred Mullane, Tennis Magazine, 7/89; Steffi's by unknown, USPTA Advantage magazine, 3/90.)



Many in the tennis teaching community conclude the arm remains in that same crooked position during the execution of the forward swing. This is known as keeping the arm in a fixed position, or swinging the arm into the ball. Photo 8A illustrates this concept, the arm remains in a crooked position between backswing and contact. In other words, the elbow remains behind the hand and forearm throughout the forward swing.



Well, there's a whole heck of a lot going on between the backswing and the contact spot. The arm doesn't remain in a fixed position, it can't. Blink, and the world passes you by, it's been said. Same here.

## **WHY IS THERE A PROBLEM?**

Much has been made about this elbow business on the backswing because of all the pictures where the pro's elbow is drawn back looking like s/he's elbowing somebody standing behind them in the eye. There exists the same image in a baseball player the moment he takes the ball out of his glove, his elbow points back behind him. But in baseball you don't keep a fixed arm and shove the ball to "throw" it from that crooked position, and neither should you in tennis.

An arm needs to be flexible if you want to throw a ball or swing an object fast, and keeping the arm in a crooked position denies this. Forehands are somewhat similar to throwing sidearm, though I emphasize "somewhat" inasmuch both offer a lateral movement around the body, and that throwing sidearm accurately is very difficult to do.

The action involved in a backswing involves taking the racket face back, not the arm. And there are plenty of pro photos showing the elbow not pointing backwards but down. The arm goes along for the ride, yes, but the racket face is getting ready to hit the ball, and the arm is getting ready to act like a spring. That the elbow goes back is like the orchestra warming up.

Looking at a photo with a pro's elbow back on the backswing doesn't mean "take the elbow back" any more than a photo of a baseball pitcher with a straight arm after release means "straighten the arm to throw a ball." This elbow business is much ado about nothing.

## **THE ARM FLEXES Laterally AROUND YOU**

It has been written that your arm is supposed to simulate "a pendulum motion" during the forehand swing, as in you extend your arm as a unit downward and then swing up. That's okay if you're bowling, but in tennis the ball's up in the air and moving by you, and the arm has to quickly swing the racket and configure itself to absorb the ball's impact against it. For quickness, adjustability, and strength, the arm (forearm) bends at the elbow and both racket and forearm travel laterally around your body.

More on the pendulum motion follows in Part II.

To illustrate how your arm flexes laterally around you, tuck your forehand elbow against your side and hold out your forearm away from your body at waist level and your hand straight up and down. Your arm is now bent at the elbow. If a clock face were beneath your forearm and hand, your forearm and hand would be pointing at 12 o'clock. Keep the elbow still and swing your forearm and hand to your left (for righties) toward 9 o'clock. This part's easy, and feels very natural. Hold this position.

Keep the elbow still and swing your forearm and hand back from 9 past 12 to, say, 2 o'clock, if you can, or only 1 o'clock. When you swing back toward 2 o'clock your forearm and hand move past your stationary elbow and biceps (and the biceps flexes to hold its position). Relax the tension you feel and allow the hand to return to 12 o'clock, noticing the spring action. This is the first part in understanding how the arm flexes laterally around you.



## THE NEAT STUFF

A powerful forehand uses the arm in much the same way an overhand throw does. Again, apply what you already know to your tennis game. A weak throwing motion keeps the arm and wrist rigid, or fixed, and lacks pronation (more on that follows later); an inconsistent throwing motion finds the arm and wrist flimsy like a pancake, or rubbery.

The big not-so-secret secret from throwing overhand lies in the relationship of the forearm to the biceps. Say you're holding a baseball and you want to throw it. You hold the ball up by your ear, turn your shoulders, and your elbow is "back." Your arm is in a crooked position. To throw the ball the elbow drops and comes forward, your hand with the ball lays back and the biceps moves forward ahead of the hand and forearm. As in the example above using the clock face to swing your hand and forearm over to the 2 o'clock position, the forearm first swings back behind the elbow and biceps that are going forward. Then, like a spring, the forearm reverses this direction to complete the throwing motion, catapulting forward past the elbow and biceps.

This motion is no different for tennis. Let me explain.

Photo sequence 8B below illustrates how to do this, it illustrates the missing pieces in all photographic analyses of tennis forehands. Photo 8B1 starts the sequence with the arm in a crooked position for your backswing, what you always see by itself. 8B2 drops the elbow down toward the court below you, as in the throwing motion, freeing the forearm to take the racket fully back behind you, and it lays the wrist back. Again, you're used to seeing this single photo by itself (Stan and Steffi above).



Now for the missing link. The elbow slides forward and gets in front of the hip (actually in between photos 8B3 and 8B4 but shown in 8C3 below). This leaves the biceps not straight up and down but angled forward, 8C3. The elbow and biceps stop their movement, 8B4 - 8B5, to allow the forearm and hand to catapult the the strings into the ball.

The 8B sequence uses the arm in the same way an overhand throwing motion does. The elbow drops and comes forward first, allowing the forearm to swing back behind it and the biceps, which then allows the forearm to re-spring forward past them both. This is the key ingredient in all top forehands, and what's missing in everyone else's. The teaching term "keep the elbow in" is often the reason this key ingredient is lacking in so many forehands, it keeps the elbow just behind the body or to the outside of the back hip instead of allowing the elbow to slide forward. This term is accurate, the elbow is "in" close to the body, but the elbow is also fluid, it shouldn't remain behind the body because it'll keep the arm crooked throughout the forward swing as in 8A above.

Photo 8C better shows how the elbow drops, slides forward, gets in front, or ahead, of the back hip, then stops to help accelerate the forearm, hand, and racket forward.



Illustration 8D mimics 8C in stick form. The upper arrow in the first frame shows the forearm will be arching back, the lower arrow shows the elbow will lower. The curved arrow in the second frame shows the (slight) rotation of the back shoulder to help boost and support the arm's intended acceleration (of the racket), the bottom arrow that the elbow will slide forward. The curved arrow in the third frame shows the hand and forearm "throwing" laterally around the body while the elbow remains still. This third frame represents the crowning achievement in racket acceleration.

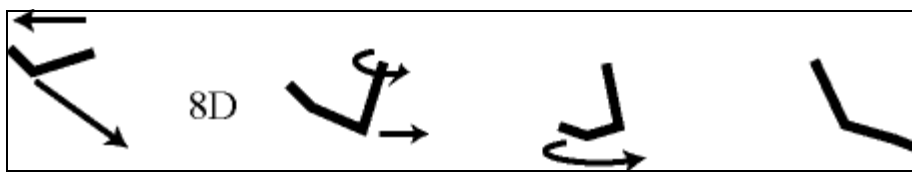
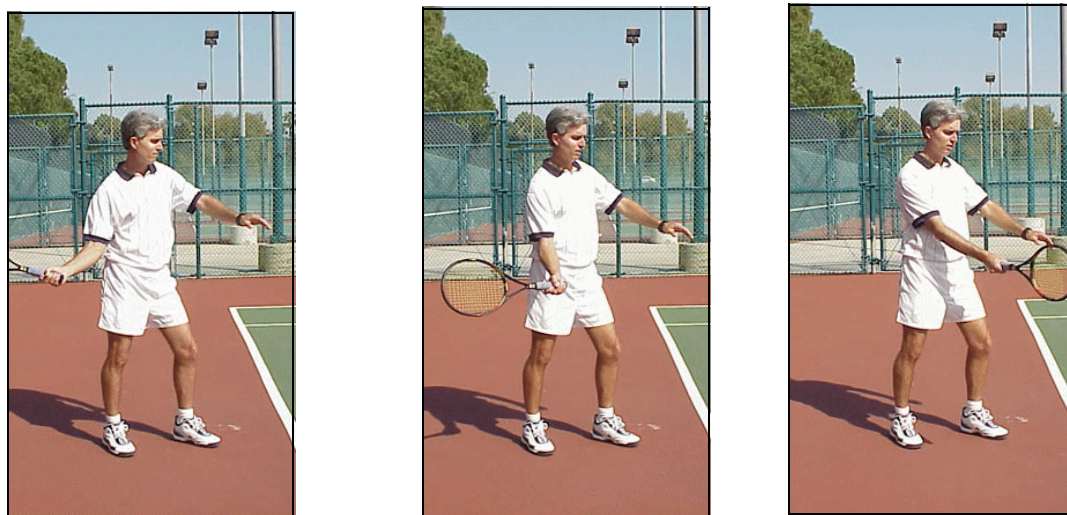


Photo sequence 8E tries, in its own simple way, to help you see this crowning achievement in racket acceleration. The racket itself travels the most distance in space, and, in decreasing increments, the hand, the forearm, the elbow, the biceps, the shoulder. The hand/forearm travel far more distance than the elbow and biceps here.





Let me shows you some pros in action to better see this really neat stuff.

Here's a nice head to head forehand comparisons with Amanda Coetzer and Chanda Rubin, both great players. In the first frame for each, the racket has started its descent, the elbow has dropped. But in the second frame notice the difference in elbow location. Amanda's is much more forward on her body than Chanda's. You can see how Chanda's elbow is behind to the side of her body, not in front or ahead of her back hip. In all fairness Chanda could just be hitting late, but then that's what that's all about, too. (Amanda's photos by Ron Angle, Tennis magazine, 6/98. Chanda's, by Stephen Szurlej, Tennis magazine, 8/96.)



Jim Courier's elbow clearly moves from behind the side of his body to in front, or ahead of, his back hip prior to contact. (Photo by Stephen Szurlej, Tennis magazine, 3/97.)



Tommy Haas's sequence begins with his arm in a crooked position, and ends with it in a crooked position. But the middle photo shows how he did not keep it that way through the swing. By seeing



his elbow pointing down like it does in the middle photo, instead of back, and seeing it so far

forward, it's safe to assume he uses his arm's leveraging technique correctly. (Photo in Tennis magazine, 5/00, by Mary Schilpp/clp.)

## ROTATION... ROTATION...

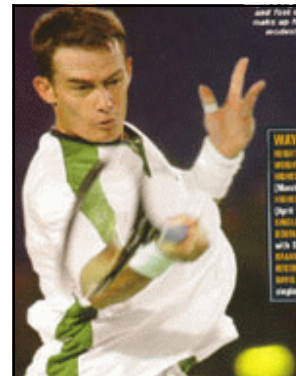
Step 4 explained the adverse impact body rotation has on a tennis swing, and that little rotary movement is necessary from the back shoulder to get the swing going or even to boost it. And if a little less than that comes from the hips, its controllable, at least. Sadly, though, the idea that if a little bit is good, a lot must be better. Not.

If the shoulders and hips rotate unabated, is there more power? Maybe in the world of sports scientists, who calculate that more "power" results when you rotate the greatest number of body parts and swing in arcs far away from the body. But how far do golfers rotate, or baseball players? Is their objective to face their playing field at contact? If baseball players felt they'd get more power by facing the pitcher at contact like a tennis pro facing the net, don't you think they would? But they don't, and neither should tennis players.

Step 6 showed how the acceleration of an arc (stroke) is greatest when the common point to the arc remains still. In tennis, this is achieved in one of two ways. Either the common point (the back shoulder on forehands) remains pretty still after a certain point, or the front shoulder acts as a brake against it to prevent it from moving too much (common on serves). When the common point moves around unabated, this acceleration principle is lost.

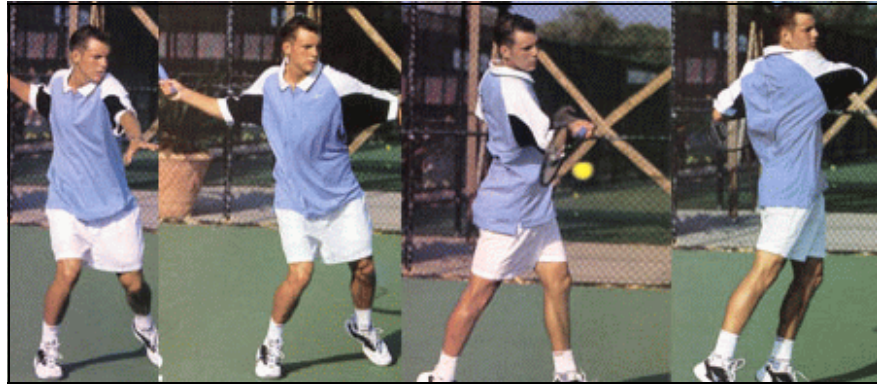
Today, a lot of rotary movement is sought on the forward swing. Too much. Not only does contact accuracy and quality suffer (because the ball is angling away from the direction of the rotary movement), but racket acceleration suffers as well. At the very least players with open stances and extreme grips should strive not to throw both shoulders around during the swing, they should strive at least to control the front shoulder and hand. The following photos explain.

Wayne Black's forehand contact matches up with a Bollettieri Academy student. Wayne's front arm acts as a braking action against the back shoulder to help accelerate the swing, which is why you can see the front arm, hand, and shoulder, whereas on the NBTA student you do not. The bend of Wayne's front arm and hand mannerism both still in front or ahead of his body explain the arm's braking action, if not the arm would simply have swung uncaringly around to Wayne's left side and out of the picture, like the NBTA student. The NBTA student has rotated both shoulders around way too much, like a boxer over swinging, which has pulled his front arm and shoulder out of the picture. Yes, it could be the camera angle, but I doubt it. (Wayne's photo Tennis magazine, 5/00, Rick Stevens/ap/wideworld photos. NBTA student, 1/00, Caryn Levy.)



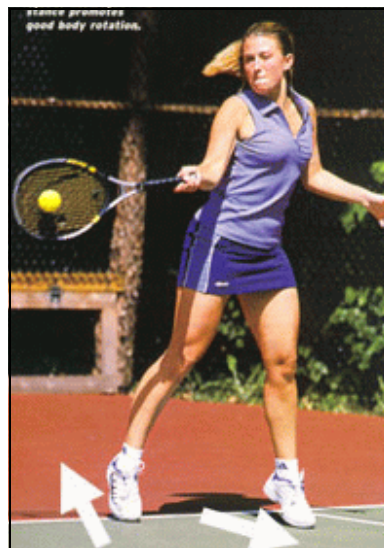


This is the entire sequence to the NBTA's killer forehand. It's clearly seen the emphasis is on "if a little is good, more must be better" idea to rotation. The rotation is exaggerated because the student's standing still prior to contact instead of moving somehow into



the ball, even with the back foot. The web site's instruction for this open stance is to "keep your weight on the outside foot until after contact," which I don't see happening here. As a result of exaggerated rotation, the follow through idea becomes similarly exaggerated.

More conflict follows. The young girl in the open stance receiving serve in the ad court is meant to illustrate the value of (turning and) releasing your hips into the shot (Tennis magazine's 101 tips issue, 10/99, photo by Caryn Levy). The two arrows I added by her feet show the historical incongruity of "how to play tennis." The arrow on the left shows the ball angling away from her, that is to her right, and the arrow on the right shows the direction of her body



weight shift, which is to her left, perpendicular to the net, following the sideline. The incongruity of the arrows speaks volumes. The two arrows need to intersect, the body weight shift needs to be directed at and into the ball at contact (per Step 2, 3, and 4). The photo on the right shows this happening, my feet (and thus body center) are pointed in the direction of the contact, which means I'm shifting my body weight there as well. (As a disclosure this isn't an action shot, I copied and pasted the ball onto my racket. But this form regarding the direction and placement of both feet and body equals success at contact, which is what Agassi does so darn well on the return of serve (upcoming in a later Step).

### HOW TO ROTATE... the right way

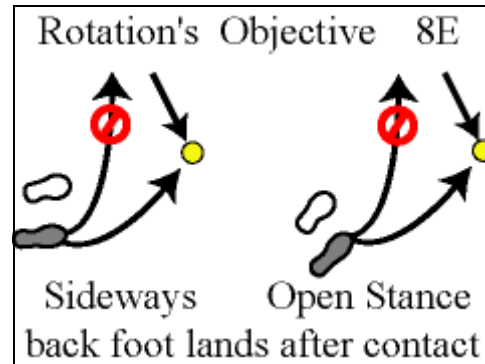
All right, I give in. You want to rotate you say? Let me show you how to and how not to.

If you're one of today's players, you're standing in an open or semi open stance prior to hitting a the ball. You're not going to step into it with the front foot, you're going to rotate your body in the direction of your shot, which is toward the net like the NBTA killer forehand above or the girl in the open stance. Or you're going to rotate so that you bring your back leg (and hip) around

towards the net just as you'll bring your back shoulder around to the net.

If you're going to rotate, rotate INTO THE BALL as shown in the photo above next to the girl and not toward the net. If you're going to bring your back leg around, bring it INTO THE BALL, not toward the net. If you move yourself toward the net, you're shifting your weight away from the ball because it's moving away from you.

Diagram 8E shows what it's like to bring the back leg around out of the sideways and open stance positions. It is very common today to swing that back leg or hip around in the direction of the net (the red circled arrows) instead of into the ball. You see this in all developing players, their back legs swing around to the net and their forehands suffer. If you need to rotate please rotate out into the direction of the contact spot and not inside it toward the net. Remember, rotation is by definition inward from the contact spot. Rotating inward from the contact spot defeats the purpose of empowering the shot.



Rotation in and of itself does not accelerate the racket. Rotation acts more as an initial combustion agent, or first phase, to racket acceleration. I've mentioned earlier about the slight re-turning of the shoulders to initiate the forward swing for advanced players and those who want to be. The same applies to "rotating" the lower body if and when you find yourself either in a sideways position or open position. In both cases the solution is a little goes a long way. Obviously if you're sideways you can rotate more than when you're open, but then you always lose control when doing more.

Power is just awesome when you rotate (though inconsistent by definition) out into the direction of the contact to encompass the ball and time the hit just right. And then it's tempting to rotate more to get more. More for more's sake doesn't exist, in so many different variations.

The final point is you actually need to do less rotation to accelerate your racket more. It's not ironic, it's predictable. The primary responsibility to rotation is to empower the contact spot. Secondly, rotation acts as a boosting agent for racket acceleration. If you overdo this boosting part its friction slows down the racket. Ultimately it is the arm that needs to work efficiently within itself for acceleration to be realized, and I hope I outlined that clearly enough when describing how the arm works to swing laterally around the body. This is the reason why you see players with great forehands so "open" facing the net after the hit. It has been the acceleration of the stroke (arm) itself that has pulled the body around like this and not the other way around. It's not about the body turning (rotating) around "and pulling the racket arm along," which is often stated.

## FOLLOW THROUGH

A follow through is verification of the type of shot made, and what follow throughs look like vary with the amount of time you had to swing forward, the amount of court you had in which to hit your shot, the amount of time you want your shot to take to reach your opponent, and the oomph you gave it.

As such, the endpoints of follow throughs vary, but there are three points to which all follow throughs should adhere. These three points are themselves flexible, as you'll see. The idea there's a certain height or length to all follow throughs ignores the simple facts the ball is ever-changing in speeds and heights against you, and your placement on the court, hitting power, ball placement and depth are ever-changing as well.

First, the racket face finishes above the hand (in height above the court surface, 8B6 above), and not finish below it per the photo on the right of the NBTA student. I've drawn two white lines to better see his racket face, which is well below his right hand. The racket edge does not need to point up directly to the sky, or stop at a predesignated height. That's exaggeration, and is reserved for little tykes needing to develop hand and wrist strength to control the swing, nothing more. When little tykes get used to it they immediately start learning adult technique.



The next two things go hand in hand. The harder you hit the ball, the better you become, the more the ball goes out. You adjust, either consciously or subconsciously, but the same two things occur besides changing your grip. Your follow through no longer stops (with the arm) extended out away from your body directly toward the net, the arm and racket start to come back to your body AND the racket faces down.

Not completely down as if looking, or facing straight down to the court by your feet, simply the racket face no longer finishes on a knife's edge, it tilts to your opposite side. And the arm bends back into your body, or recoils. Keeping your arm extended out away from you is entirely arbitrary and forced. No one throws a ball like that. It's both natural for the arm to recoil, and for tennis players this move withdraws power because the playing surface is so small. In baseball and golf, with their large fields, you hit the ball and e-x-tend while doing it. If you extended similarly for tennis, you'd hit it over the fence. More on this follows last in Part II at the end of this section.

The elbow and arm are kept in front of the body, and the height of the hand varies. The popular idea to follow through to your opposite ear to hear the ticking of your wristwatch on your forearm wrist compromises the contact value of what is an ever-changing ball in an ever-changing situation.

### **TOPSPIN THE WRIST... ROLLOVER... PRONATION**

Spin is simply a matter of the strings brushing against the ball. Without a brushing effect upward, downward, inward, or outward, what you'd get is a ball hit with no spin. For topspin the racket face is vertical against the ball at contact, that is straight up and down, and it brushes up because you're swinging low to high. But there exists great controversy in the teaching community regarding the delivery method to place the racket face vertically against the ball at contact.

The controversy centers around the use, or non-use, of the wrist. Is the wrist in a fixed position for both backswing and forward swing, or does it move? Does the rollover action contribute to topspin, is pronation involved?



The status quo always cops out by saying pro A hits the ball a ton because he does use his wrist/rolls over/pronates but that you shouldn't. One well published guy even says to keep the arm and wrist fixed throughout backswing and forward swing to "minimize every possible chance for error." Condescending, isn't it.

Some of these status quo guys never had a heavy, world class forehand. Some former top tenners didn't either, though you'll see them in popular tennis literature showing you how to hit a forehand. But when greats like Pancho Gonzalez, Rod Laver, Pancho Segura, and Bill Tilden all talk about using the wrist, I think those who call themselves tennis sports scientists should try to figure out what they're doing with the wrist instead of disproving what they're saying.

That's right, the popular tennis sports scientists of today, not a world class tennis player among them, actually try to "prove" that what tennis greats and Grand Slam winners like Gonzalez and Laver are saying about their wrist movement is wrong. Imagine that. And to those few well meaning sports scientists who say top athletes can't articulate what they're doing, if you ask the right questions, and listen to the answers, you'd be pleasantly surprised.

## PRONATION

Welcome to the Holy Grail for tennis players, both now and a hundred, or even fifty, years ago. Back then tennis books didn't mention pronation, they mentioned the "use of the wrist" during the forehand swing. Now the 1970's came along and the establishment interpreted the "use of the wrist" to mean wristy, or floppy and declared it unwise to "use the wrist" because it was much too difficult to control the wristy floppy thing. Hence, tennis students were told to lock their wrists during the forehand swing to protect themselves from themselves. Ugh.

Well, I believe in you, in your human body. Sure, there are some people who are too this or too that in their manifestations of physical acts, but they too will follow the yellow brick road to find their way home.

The "use of the wrist" back then is what we call pronation today. The establishment didn't grasp it then, and still doesn't now. It's not wrist, it's pronation. Hallelujah.

Pronation means rotating the hand or forearm counter clockwise, so the palm faces forward, then downward, or, in the extreme, back. This has nothing to do with the degree of rotation, pronation merely describes the direction. If your hand was palm up and you rotated just 90 degrees to make it vertical, that forward direction is called pronation. The opposite is supination, rotating the hand or forearm clockwise so the palm either faces upwards or, if it was facing down to begin with, it turns upwards to face forward.



Pronation is just a fancy word for rolling the hand and forearm into the ball when you hit it. In most pros with rocket forehands, like Tommy Haas here, the racket face rolls over, creating a



unique after-effect. But an after-effect of what, a fixed wrist or a pronating one?

During contact, most of the time the force of the ball tweaks the racket face adversely, either causing the racket face to close or open. In the exception, if you hit the ball pluperfectly in the center of the racket with just the right upward angle of lift, the ball doesn't tweak the racket face. Now your job is to keep your racket face vertically against the ball as you brush up low to high. How can you do this when the ball's tweaking the racket face? You can either hit the ball pluperfectly, or you can plan to counter the ball tweaking against the racket face. You can plan to apply a counter force.

Giving a friend a high five illustrates a counter force. If your hand goes backwards and down on a high five, you didn't counter your friend's hand. Repeating the action, if you counter(force) your friend's hand yours remains up high.

Good measures to counter the tweaking of the racket face at contact are keeping your hand firm and your wrist strong, but these are more reactive rather than active measures. The status quo asks that you keep your wrist fixed during the whole swing, but that doesn't provide a counter force to the contact, it merely resists. Pronation applies an active counter force to prevent the racket face from tweaking at contact.

Does the wrist snap or break? Not at all, that's for a serve, or overhead. Does the wrist roll over? No, that's an exaggeration. But the counter force of the hand, and thus wrist, plays an integral part in what is the last ingredient for racket acceleration.

First, your wrist has a natural spring to it. To illustrate, with your forehand elbow by your side, extend your forearm straight away from you and keep your hand on an edge, straight up and down. Now lay your hand, or wrist, back. Feel the tension in there. Keep the forearm still and relax that tension. Hopefully your hand springs back to its original position. If not, repeat the action but angle your hand downward somewhat before you lay it back.

The wrist-as-spring idea is evident in the preparatory hand action you see in all the pros' pictures (above) during the backswing, the hand lays back, or the wrist cocks back. The hand, too, flexes around the wrist, as the forearm around the elbow, the biceps around the shoulder. Denying the natural use of your hand in this manner is like trying to walk with your shoelaces tied to each other.

Second, the arm naturally turns inward. When you walk the palm either faces your leg or behind you. If you extend your arm away from you palm side up, you'll lower the arm and the palm rotates to face your body. The arm naturally pronates.

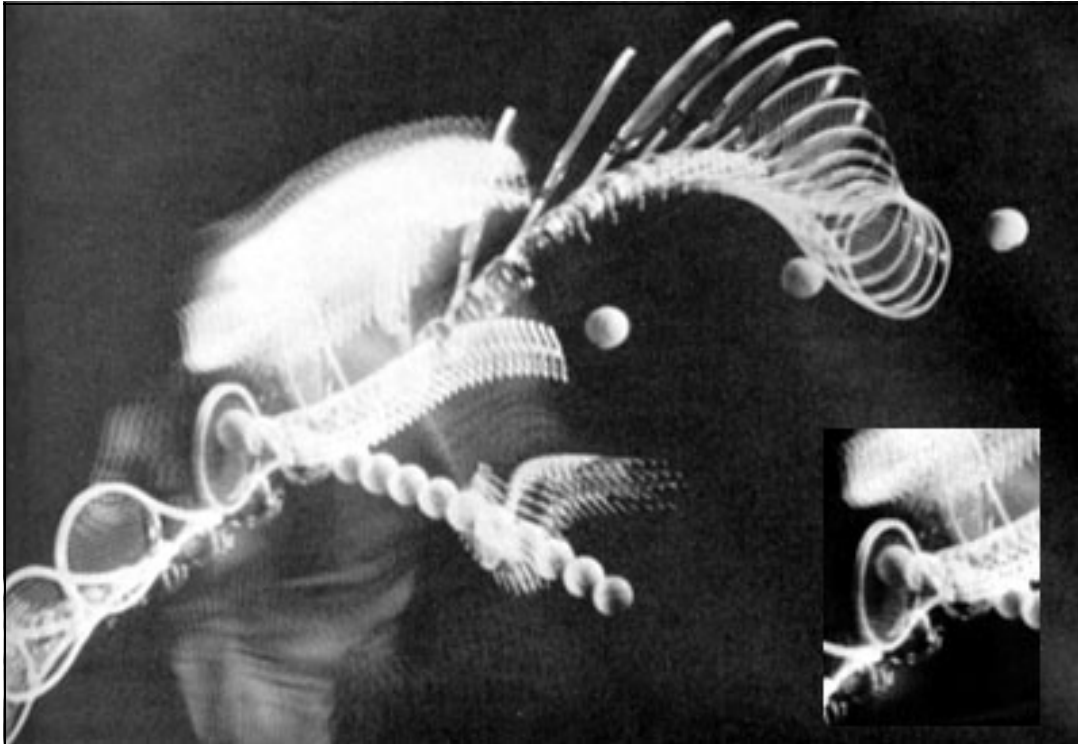
Adding wrist flexibility and pronation with an arm that is flexible throughout the swing creates the proverbial cannon.

Is this cannon hard to set up and fire? Heck no, just let nature takes its course. Lay the wrist back to start, keep it strong and vow not to flop it, and you'll naturally access it during the motion. Again, less is more. Oh you'll hit the ball out in the beginning, that's expected, like what happened when you first hit the gas pedal on a car. But you can handle it. And pronation? Just simply roll the racket or the hand into the ball on the forward upward swing, that's all. Counter the ball, don't ever try to keep the wrist or arm fixed. More follows in Part II at the end of this section.

## CRITICISM

The tennis establishment says pronation isn't responsible for creating topspin. The establishment opines that topspin is created solely by a vertical racket face brushing low to high, and that to best achieve this the arm and wrist will remain fixed during the swing. The following is photo evidence used to support this belief. I'll include the accompanying quotation and you can figure out what's being said, not said, and what's being inferred.

"All that talk about how the racket face "rolls over" the top of the ball to impart topspin is a myth. In this photo (the first of this nature ever recorded), the hitter tries desperately to roll the racket face over the top of the ball - but to no avail. The racket face is vertical at impact as it moves

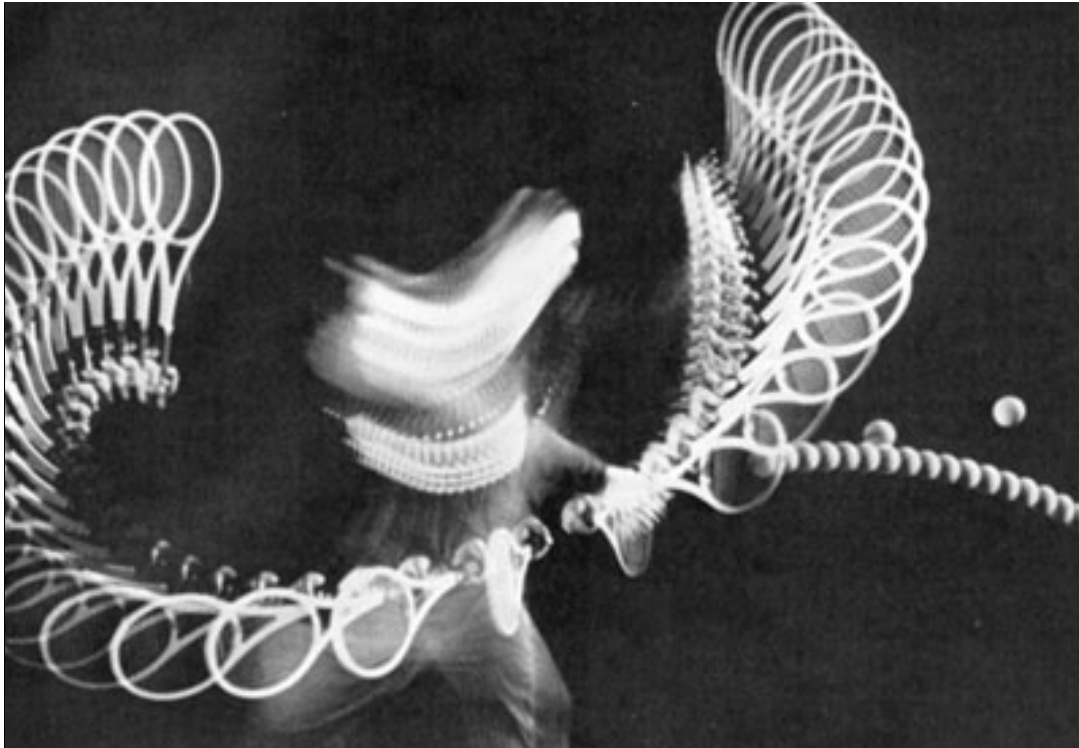


from low to high. High-speed motion pictures also substantiate that the ball leaves the racket face long before the racket face begins its rollover." (Photo by John G. Zimmerman, published in 1977, *Tennis For the Future*, by Vic Braden, and the one following.)

This proof is used to show how topspin is not created by the racket face going over the ball but by the racket face being vertical against it. Never mind it is admitted the racket face clearly rolls over after contact, it's just that the establishment feels this rolling over action has nothing to do with the stroking dynamic to place the racket vertically against the ball to produce the topspin. (The inset photo shows the contact and the racket's angle immediately following. I feel the racket face has opened a bit, gone backward, in this first frame after contact, which is predicted and shown in other hitting models, but I could be imagining it. If it is, it explains the presence of the rollover, or pronation, prior to contact.)

The establishment then uses this "proof" to structure a unique topspin schema, shown in the next photo. Here the racket impacts the ball vertically, and the hand and forearm, which remain fixed throughout, will not roll over even after impact. Curious, though, how the racket is more than vertical at impact, it's rolling over, and then rights itself later?

According to the establishment's sport scientists who undoubtedly influenced an entire generation of players and teachers, pronation is not absolutely necessary to create topspin. That is, a vertical racket face creates topspin. While literally true, it is shortsighted.



Let's talk karate punch for a second. If you were to take a stop action photo of a karate punch the moment it struck a wooden board held out in front of the student, the fist would be flush, or square, against the board. The knuckles go left to right, the palm is down. Does this mean the hand was so placed from the beginning when the student threw the punch? No. The karate student starts with his fist palm up, held by his side, and then corkscrews his arm (pronates) to deliver his punch with the palm facing down at contact.

The same happens when you throw a baseball. The same is acknowledged to happen on a tennis serve, that is pronation. Well, pronation is how the arm delivers itself for strength. And it holds for all forehands, except slices.

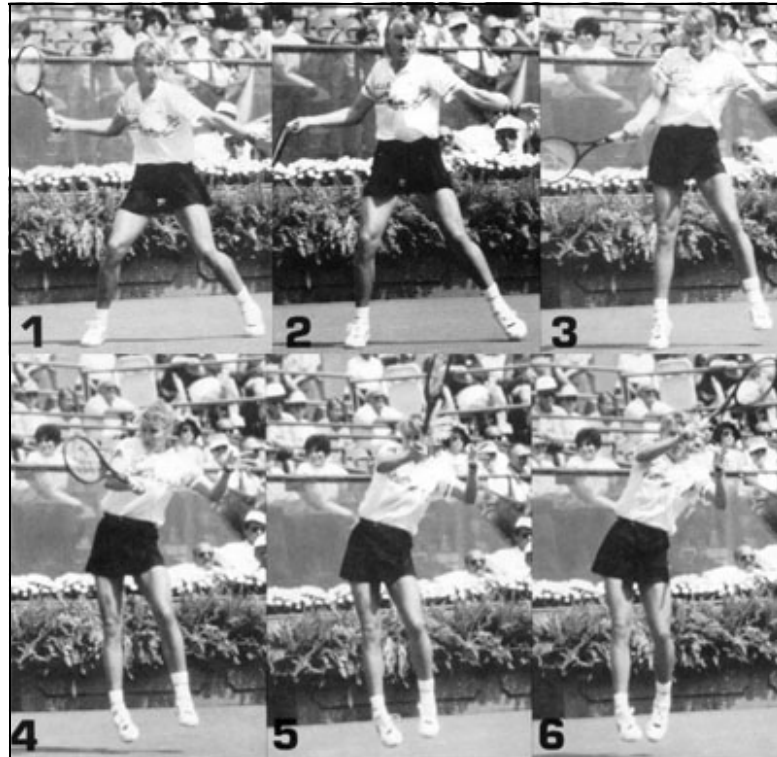
## **REVOLUTIONARY**

The tennis establishment has said that pronation is not mandatory on a forehand to produce topspin unless "a person were hitting with a racketface pointed upwards and was forced to roll the forearm in order to properly position the racket [vertically] against the ball." This was included in an email sent to me January 29, 2001. As seen earlier, pointing the hand upwards is the direction for supination, that is rotating the hand in the clockwise direction. The tennis establishment is saying pronation is not mandatory to produce topspin unless supination occurs first. This in fact happens.

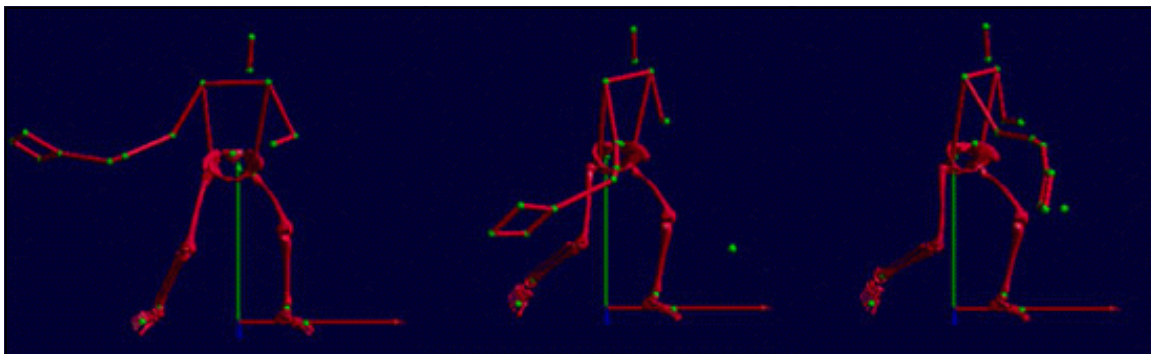
The following sequence from Steffi Graf shows her racket face first pointing upwards during the

forward swing before she corrects (rolls) it to place the racket face vertically against the ball.

The angle of her racket face in Frame 1 is perpendicular to the court below, using a north south axis, or top to bottom. In Frame 2 this angle has changed, the racket face is leaning back, or open, or pointing upwards slightly. The hand has supinated, it rotated the palm upward. Frame 3 returns the racket face perpendicular, closing it prior to contact. What does this mean? It means the hand reversed its direction to place the racket face vertically against the ball, it means the hand pronated. The signature proof of this shows up in the contact shot and follow through. The contact photo is missing from this publication, I couldn't track it down. Frame 4 is post contact, and the racket face, predictably, has opened a bit, but it's nowhere near the very open angle of Frame 2, it is still being held in the "vertical" position. Frames 5 and 6 find the racket face more than perpendicular, confirming what the hand was doing between Frames 2 and 3. More follows.



What about the players who keep their racket facing down on their backswing? They, too, wind up rotating the palm upward to place the racket properly against the ball. No, not pointing upward, just rotating the hand in that direction (as opposed to down). Consider: Tommy Haas above has his racket very closed in frame 1, more than perpendicular, and in frame 2 it is perpendicular. Hence, logically, it must have opened.

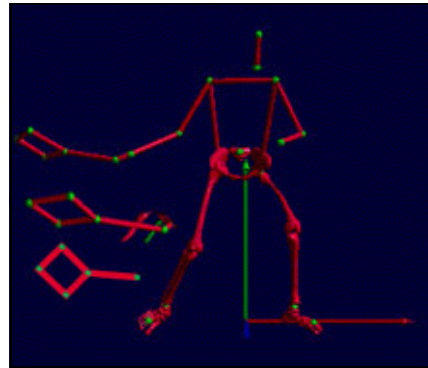


In Tennis magazine's march 2001 issue, there was a look into tennis' future. In a sidebar was a stick figure of a top pro hitting a forehand, and I include here the representation from the company's own website (identified below) because it's clearer than scanning the magazine's image.

Notice the angle of the racket face in the first frame, it faces down somewhat, denoted by the narrow looking racket face. In the second frame the racket face isn't as narrow anymore because it has opened. The third frame finds the face close to perpendicular. The racket hand supinates, or rotates upward/forward, in this sequence to place the racket vertically against the ball. For close readers, notice how the green dot representing the elbow in the middle frame moves to get in front of the back hip, as shown in 8C above.

Very interesting, isn't it. And if you really don't see it, this additional frame showing what each racket angle would look like in the backswing if the angle did not change at all during the forward swing may clarify it.

The top racket belongs to the first frame, the racket is back and faces down somewhat. The middle racket belongs to the second frame, and I matched the tilt to the first racket. The bottom racket I drew and corresponds to the contact angle in the third frame above, close to perpendicular, and I did my best to be honest with it. It's supposed to angle toward the viewer a bit. Examining the racket face's angle from top to bottom, the racket face opened in order to place the racket face perpendicular against the ball for topspin. The hand supinates, or opens up, during the forward swing. It doesn't point upwards to the sky, but it's in the process of rotating upward from its downward facing position.



### THE LOGIC

Now, let me ask you, is the racket open at contact? No, it's vertical. Why doesn't the racket face open up at contact if the hand opens to begin with when placing the racket vertically against the ball? Because the hand stops that movement prior to contact. Is the racket face open then after contact? No, it rolls over. Why? Because at contact the hand is going in that direction, that roll-over direction. And that direction is called pronation.

Or look at it this way. Which is easier. Will the supinating hand stop its upward rotation on a dime and at just the right angle and stay fixed that way when the ball tweaks the racket face, or will the hand reverse itself to counter both the upward momentum from supination and counter the tweaking of the racket face at contact (pronation)? Hey, just look at the follow through, that roll-over thingie. Why is this so hard for the tennis establishment to grasp? Beats me.

The answer then is clear. Pronation "properly positions the racket against the ball" because the racket "has been pointing upwards first," using the establishment's own criteria for accepting the idea. Please notify any tennis establishment members you know of (easily found in the magazines and on the shelves), and tell your own local pro about this argument. You'll be helping yourself and all those young kids behind you. In addition, please contact the good guys at TennisWeek, and Tennis Magazine to enlist their help and put an end to the medieval belief that pronation is not a part of a tennis forehand groundstroke.

The good people of Bio-Kinetics Inc., of Salt Lake, Utah, are responsible for the stick sequence above, and Mr. Paul Reddick took the time to inform me that, in their view, the racket opens

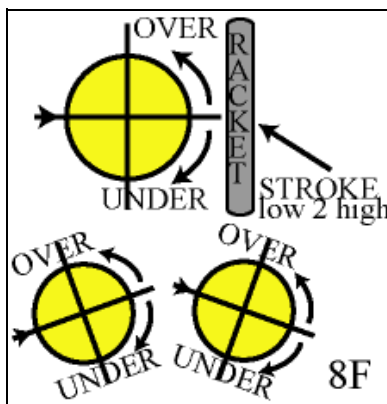


"because the hips turn to strike the ball," and that the racket face closed into the ball because of the symbiotic relationship of the two elbows. I argued it was because the hand pronated, and the response I got was that pronation is a non-teach thing. Bio-Kinetics, Inc. is heavily into baseball and offer that some things are non-teachable things, such as pronation, as in when throwing a ball. I proposed that while in baseball pronation may be a non-teach thing, in tennis pronation on a forehand and serve is a must-teach thing, and we found common ground. I'm glad I found them, and I thank Tennis magazine's editors for that.

One last word. The establishment responds that the roll over obviously seen after contact is about releasing the forces of the musculature, and they further state that Andre Agassi "went nearly eighteen inches past the impact point before his wrist made a single degree of displacement [that is pronation]," and that there was no displacement before contact as well. And in the late 19<sup>th</sup> century we used to think a galloping horse always had one hoof touching the ground at all times.

### OVER THE BALL AND UNDER THE BALL

The next photo is of Monica Seles, and it clearly shows the angle of her racket to be more than vertical on the ball. Underspin for groundstrokes is known as slice, and its execution is commonly understood. The racket face is beveled, and you hit under the ball. Of course you don't literally hit the point farthest beneath the ball, you'd send it straight up like a geyser. The image is that you hit in the direction under the ball as opposed to in the direction over the ball.



Topspin is also known as overspin because the racket strikes the ball by going in the direction over the ball. It doesn't strike the ball literally on the top, that would send the ball down to your foot, but the image is that the racket moves from low to high brushing the ball upward and in the direction over the ball.

8F shows the image of how the racket goes "over" the ball for topspin, regardless if it's rising or falling. Enough said.

### DISCIPLINE

I hope this has been of some use. As mentioned from the very beginning in revolutionary tennis, what helps your stroke the most is improving the use, response, and structure of your body toward a ball angling away from you, as well as simplifying where to place the ball.

Strokes don't exist in and of themselves, they are dependent on the body, on its locomotion, balance, structure, sensory input. Strokes require their own self discipline, and stroking requires body self discipline. Not every ball can be hit large, not every deal is a gangbuster.

But you must improve the use of your arm to improve your forehand.



## ADDENDUM



In this montage of shooting a basketball it appears there is little if any wrist movement at the release point, similar to Vic Braden's idea that on a forehand topspin "there is not a single degree of wrist snap at the impact point." Even though we know the wrist snaps when shooting a basketball, evidenced by the characteristic flop-over after the shot is made, this basketball montage could be used to argue the opposite, that is the basketball player's wrist remains locked or fixed throughout the upward delivery. It can then be revealed the "secret" to shooting is the moving or straightening of the arm as a lever like a catapult and that the wrist snap seen after the release has nothing to do with the shot but has to do with the release of natural forces. Then it becomes a "myth" to snap the wrist when shooting a basketball. It's okay to laugh, but this is what happens to us in the tennis world regarding a topspin forehand groundstroke. Using the word "snap" for a tennis forehand's wrist movement is exaggerated, but it does work on a basketball shot even though you don't see it happening until after it's happened.

The photo on the right of the USC player shooting clearly shows the ball out of his hand with his hand/wrist still extended, or in the laid-back position. A tennis "scientist" would use this photo to opine there is no wrist snap, or forward flexion, to a basketball shot because there is no flexion seen at the release point, or impact point.

Agassi says he uses "a lot of wrist" in his shots, but Vic Braden, et. al., look at high speed video of Agassi's forehand and proclaim Andre is not using his wrist because wrist displacement (deviation/flexion) is not seen at the impact point but is seen only "long after" contact is made. Many tennis people believe Vic has proven Andre wrong, perpetuating this narrow mindedness.



High speed video is good for observing broad issues but it is not discriminating enough to discern something as small and as quick as wrist usage, even at 40,000 frames per second. Only when the hand and wrist are wired for feedback to determine the yea or nay of flexion, extension, and deviation, the yea or nay of when and if the hand squeezes, will we be talking testable hypotheses. Until then all this talk interpreting wrist usage from high speed video analysis is just observation, not science.



I include the imagery used to proclaim no wrist usage in Agassi's, and Federer's, forehand. During the forward swing it is indeed noted the wrist flexes forward somewhat from the fully extended position but that the wrist *remains still extended* prior to, during, and immediately following contact. The top left and center photos show what the wrist looks like immediately following contact, and it also looks just like this prior to and during contact. This is the look from which Braden, et. al., opine the wrist was not moving [flexion] "a single degree...at the impact point." The second photo on the right of Andre shows a second angle of his middle photo. Of note is Federer shows radial deviation.

This 4some series shows the concluding look to the wrist after this so-called non-flexing wrist of Agassi and Federer assumed from the photos above. The top left in this group shows the characteristic setup with the wrist fully extended, common to both. The next three photos occur just a fraction of a second later than the series above, with the ball still visible in the frame. Similar to the basketball montage above where what we know to be wrist usage during the shot is seen after the release of the basketball, our wrist usage during the shot is seen after the ball has left the strings: flexion and deviation. And it wouldn't surprise me if we see it within a similar timeframe after contact as we see in basketball after the ball's release.

Look, even if I did snap my wrist on a forehand what do you think you're going to see on film at the



impact point, the wrist flexing forward? No, because I'm wielding a 27 inch long, 10+ ounce stick with a flat surface on one end in a particular way against a ball moving at X miles per hour against it.

## NO MORE SPIN

I don't know why self-styled scientists, academics, analysts, continue down this road. I ask you, do you believe that professional athletes can't communicate what they are doing, that they don't know what it is they're doing when they do it, that their auto-feedback systems are faulty at heart and can't be trusted? Maybe...? Then consider: professional athletes will try another way in a heartbeat if they find it's a better way, they don't have an ax to grind, or a position to defend. All say they use their wrist, none says they don't. It seems to me those who can't hit a ball like a pro need to swallow their pride and heed the pros' advice and then get in the business of describing how they do it so you can do it too. But denying the use of the wrist in our strokes as deliberate upon the impact point is laughable, and it's also sad because a lack of accurate information directly impacts our recreational players adversely. Ignorance is bliss, they say, but here ignorance spins with aplomb. ¡Ay no!

[USC/UCLA basketball photo, Robert Gauthier, LA times, 3/15/08. Three f/h montage, Federer unknown, Andre Getty images, Andre return, Mary Schilpp/CLP, Tennis magazine, 11/00; Federer forehands, USTA's High-Performance Newsletter Vol. 6, No. 4/2004.]



I'm adding shots of Sharapova, Roddick, Agassi, and Federer forehands milliseconds after contact that clearly show the player's stroke and strike pattern. The racket face rollover is not part of a secondary strike pattern, it is primary and the act begins prior to contact. Vic Braden's statement above, "The racket face is vertical at impact as it moves from low to high. High-speed motion pictures also substantiate that the ball leaves the racket face long before the racket face begins its rollover" was based on his singular attempt to document topspin in 1977. In the face of so much photographic data offering more information on the topic, and considering he will not entertain any other interpretation of his own data and that his attempt was not a true experiment since the method was not testable by peers, I would conclude his statements are to be interpreted as belief and not science.

You don't snap the wrist on a groundstroke, far from it. But the wrist is being used, it moves, it flexes, it is not held fixed or locked. There is both flexion and deviation during the forward swing prior to contact. Freedom from ideologues. Freedom from demagoguery.

## Freedom.

[photos montage forehand: Sharapova by Gina Ferazza, LA Times, 3/19/06; Roddick by Mark Baker, Associated Press, in LA Times, 1/20/06; Agassi and Federer Getty Images uncredited from the usta.com web site.]

## OLD THINK

- elbow back
- keep wrist fixed
- swing like a pendulum, arm fixed
- keep elbow "in"
- hit topspin with fixed wrist
- follow through up and out, or extend toward opponent, or wrap around behind you
- rotate to the net

## NEW THINK

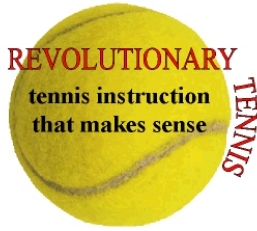
- take racket face back
- wrist flexes back
- wrist flexes back
- elbow slides forward
- pronate for flat or topspin
- follow through arm bent in front of body, racket face down a bit and above the hand
- if you rotate, rotate to the ball



# Revolutionary Tennis

## Tennis Instruction That Makes Sense

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### Step 8

## The Forehand Groundstroke Part II

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### THE LOOP

There no longer is a debate on whether you take the racket straight back or do a loop. There are two movements, or beats, to the loop. Keeping these two beats separate and using each in its own time frame speaks to rhythm and acceleration. Players run into trouble when they blend both beats, that is when you get the racket down too soon and it waits before swinging up.



You start the loop and move at the same time, photo of Amanda Coetzer far left, first one. Move forward into the ball (Step 1), with the right footwork (Step 2), for the forward stance, if not an open forward stance (Step 3). Keeping your racket up in the first beat of the loop until just before the ball bounces does tax your ability to drop the racket and swing forward on time, but it's the only way to go. The next three photos of

Amanda compile the second beat. Sure, it makes it a little harder in the beginning, but this is how it's done. In a short amount of time you'll get the roller coaster effect and it'll feel neat.

### RACKET FACE DOWN?

The racket face can, and often does, face down when you lower the racket before bringing it up and into the ball. However, it is not absolutely necessary for the racket to face down on the backswing.

Let me repeat that. It is not absolutely necessary for the racket face to face down on the backswing. This is a (good) device to help your racket do the really important thing for contact, stay vertical. But what's responsible for the vertical contact is pronation, which follows, not keeping the racket face down.

## BACKSWING DEPTH AND DROP THE RACKET FACE BEFORE LIFTING



The accompanying photos relate to backswing depth, dropping the racket face before lifting, and dropping the racket race below the hand (witnessed in all the pros and the stick figure in Step 8 previous). Backswing depth relates to getting the racket back deep enough in the backswing, not keeping the elbow "in" close to your body (center photo above). Of course if you get it back literally you run the risk of straightening your arm in the backswing position, which is a bad thing (photo left above). The elbow is off the body and the arm is bent (photo right).

Nicholas Kiefer below shows this backswing depth and the bent arm in the photo on the left. It's common not to get the racket back deep enough, sort of not like not taking a ball all the way back before you throw it for distance. You need to give the racket a ride during the forward swing.

Next, the ball rises, levels, arcs down, and your racket face needs to drop below the contact height in order to lift and brush the ball for topspin (Kiefer center photo). Make sure you drop that racket as the second beat of the loop. How to? Relax your wrist to lower the racket face (Kiefer center photo). There is no need to keep the racket face and the hand at the same height above the court surface either throughout the swing or during contact.



## THE ARM, THE LATERAL FLEX AROUND THE BODY

Break up the arm in half during your swing and allow the forearm to swing around your body. The biceps stays real close to you at this point, and your elbow, too. Of course if you literally swing around your body you'll hit the ball to the side fence opposite your forehand side. At some point prior to contact, and throughout the contact, the swing is no longer an arc but straightens out, as in the stroke's pattern straightens out and directs itself with the ball toward your intended ball placement area, not over to your side. The follow through tails off

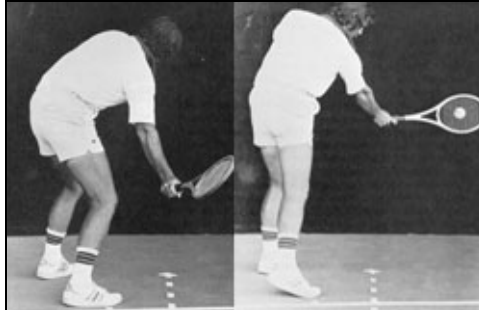




to your side, yes, after you've (hopefully) hit straight.

If you see only the last frame in the sequence above, you might misconstrue the arm is swinging like a pendulum because you haven't seen the arm's entire sequence. If you drop the arm (and racket) down like a pendulum as in bowling or golfing your swing, well, you're not being a tennis player.

These pictures illustrate the pendulum motion. You start this motion with the racket face facing



down, and it's offered a pendulum swing places the racket face vertical against the ball, the black and white photo above (photo by Vic Braden from his 1977 book, Vic Braden's Tennis for The Future). If a true pendulum motion is used, as in the color photos on the right, the angle of the racket face will not change because the hand's angle does not change. The only way the angle of the racket face can change to a vertical position is if the hand supinates, which it does in the b&w photo.



The arm should never lock or be kept fixed, rigid; the forearm should never swing as one with the biceps. Ouch.

## THE FORWARD FLEX TOWARDS THE BALL

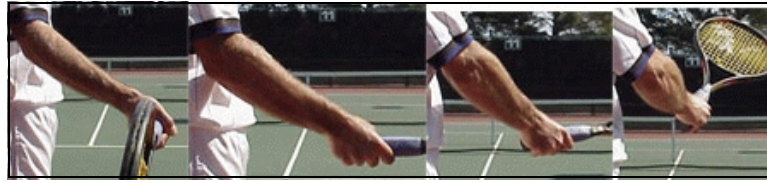
Okay, you're understanding how not to straighten the arm when swinging forward. But is the arm as a whole flexing backward and then forward?

The arm as a whole moves back (backswing) only to move forth as in a wave. It undulates, or flexes, during the forward swing besides the forearm flexing around the elbow and biceps laterally.

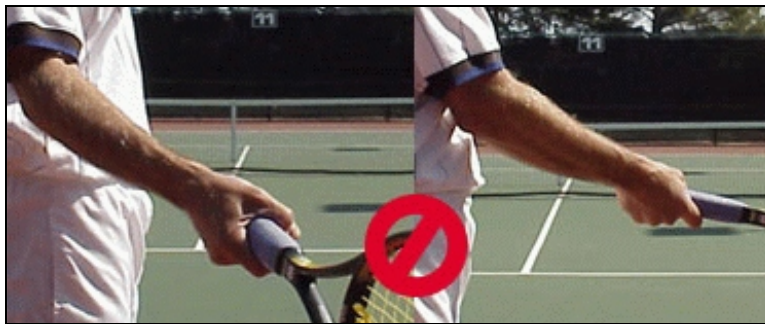
If I were teaching you I'd ask you to throw sidearm during your forward swing, or ask you to flex the arm forward, or break the wrist, or... These are merely words, and I use them cautiously. Everyone interprets words differently, and it's my job to find the right one that helps you. You might break your wrist and it'll be way too much, someone else might "break" it just the right amount. This is a teacher's challenge.

## PRONATION

Pronation isn't difficult to do or to control. Roll into the ball during the swing. Not flop into it, not roll the wrist over, just roll into the ball in a counter clockwise direction to counter its force against you. For those teachers and organizations who decry this idea, time to let go.



The above photo tries to show how the hand, wrist, and forearm move if you want to flex your wrist and pronate. First photo left shows the hand/wrist, laying back, or cocked, about to swing up and forward. Second photo left tries its best to reflect the amount of lateral forward movement of the wrist, very little, and that's it, that movement stops right there. Simultaneous with the mild lateral wrist movement is the forward rotational element of pronation, shown separately in the third photo from the left in order to see it better. The last photo shows the post-contact signature pronation before the follow through tails off to the left.



The photo on the left shows a fixed wrist in the backswing, it remains straight, it does not lay back. And while even less-than-slight pronation is still present using a fixed wrist and produces topspin, though fixed wrist advocates are also non-pronation believers, there won't be the characteristic pop on

the ball or on its bounce. The hand needs to be used, not abused.

Critics argue pronation adds a layer of work, and that a fixed wrist is just one less thing to do. Not true, keeping the wrist in a fixed position is something to do as well, it's work. And I think it's less work to swing naturally, that is to pronate, than to swing using a stilted form, a fixed wrist.

Critics argue it's easier to keep the ball in with a fixed wrist. True, but then you're poking at the ball, you're not getting the big forehand. Riding a tricycle is easier than a bicycle, and bowling with two hands just may avoid the gutter, but undoubtedly you've grown and left the tricycle behind. Same is needed here, your forehand needs to grow up. And it can, no problem.

Interesting how critics never argue you can hit the ball harder by keeping your wrist fixed. Hmm.

Try pronation, you'll like it. But please, keep the arm flexible while doing this, and don't roll the arm over literally.

## **SHIFT INTO THE BALL**

Sounds like a no-brainer, but don't forget to shift your body weight into the ball (Step 4). Too often you'll forget this little bit of business when trying to improve your swing and just stand there and arm it. Maintain your balance to control your power (Step 5).

## **ARM CLOSER TO THE BODY, OUTSIDE IN**

Your arm reaches out wide to find the ball that's angling away from you, when it's at its widest from you. Then your arm compresses in toward your body instead of swinging away from it to maximize leverage and speed, similar to throwing a ball, known as outside in (Step 6). A card carrying member of the tennis establishment says the swing works inside out, that is your arm keeps moving away from your body laterally toward the same side net post during the swing. Sigh.

## **THE MIDDLE OF THE BALL, AND BEYOND THE BALL**

You make contact with a ball angling away from you, and more often than not your swing's direction follows the (incoming) flight line of the ball to hit through the middle of the ball (Step 6). If you don't have enough zip on the ball, think of hitting beyond the ball or of the acceleration techniques in Step 6. Instead of dropping the racket face well below the ball to brush up on it a lot for lots of topspin, don't drop it so much and reduce (level out) the upward angle of the forward swing for more pop on the ball. Place the ball based on your time and your stroke (Step 7).

## **JERK THE RACKET UP AND OVER THE BALL**

I use the phrase jerk the racket up and over the ball because forehands are beastly. You don't swing the racket nicely on a forehand, the ball won't pop out of there. No style points here. So squeeze the racket handle and jerk the racket over the ball.

## **EYES AND HEAD STEADY, SWING LOW TO HIGH**

This is obvious. Swing low to high and keep your eyes and head steady on the contact point 'cause your swing can easily pull your head out of there.

## **THE FRONT HAND STEADY**

Keep the front hand in front of your body, don't let the fact you're swinging around pull the front hand out of the way to your left. You can say the same thing about the front arm or shoulder, but it's easier to focus on the hand, which then keeps the other parts in line, too. Together with keeping your head still, this is the last part that helps to accelerate the racket. You can see this in the comparison between Wayne Black and the NBTA student in Step 8.

## **HIT UP OVER THE NET, NOT FOR LENGTH OR DEPTH**

Most everyone incorrectly hits the ball on a line drive for depth. In so doing, you'll keep the arm extended away from you towards your opponent. Wrong mind set.

There's an obstacle in the way you first need to consider, not the baseline. The net. You need to hit up over the net first.

Pros hit the ball up and the depth takes care of itself. How? By the low to high lift angle and the angle of the racket face. So think about hitting up first. Spin keeps it in, as well as not e-x-tending the follow through.

Sure, you can hit up too much and the ball goes out. Duh. That's another reason why these l-o-n-g follow throughs don't help. Think topspin and not length of hit.

## **TIME**

Just how much time do you have to hit a ball? A baseball batter stands almost 67 feet away from the pitcher and has .505 seconds in which to time a 90 mph fastball. A tennis player moves, and then times his forward swing by the bounce of the ball. A 90 mph tennis drive is going half as fast after the bounce. If this drive bounces 5 feet from you, you have a whopping .075 seconds in which to time the hit. If there's 8 feet, you have .121 seconds.

And if you're facing a 60 mph drive, which is going 30 mph after the bounce, within five feet you have but .114 seconds, in 8 feet you have .18 seconds. Not much time.

Calculating this way applies more for a serve, where the ball kind of moves straight up as opposed to a groundstroke where it rises and crests, slowing down even more and allowing you more time before you hit it.

The point is clear, you have little time to make things happen right, but a lot of time to screw things up.

## **YOU HAVE FOUR MILLISECONDS TO SCREW UP**

If having less than two tenths of a second in which to be properly positioned and time the forward swing isn't bad enough, it gets worse. The ball's on a pro's racket for 4 to 5 milliseconds. That's .004 seconds. Even if everything's perfect within your first window of time, there's an even smaller window coming up.

Before you reach that 4 millisecond event, bad stuff can happen. It all boils down to this, you get ahead of yourself. It's hard to keep it together between 2 tenths of a second down to the last 4 milliseconds. What happens? You're going to start moving away from the ball before you strike it either through rotation, equal and opposite reaction forces, desire to start repositioning, or by trying to sneak a peek at your result before you've actually hit the ball.

And if you don't get ahead of yourself, in less than 4 milliseconds seconds your body can still adversely impact your swing. Not consciously, subconsciously. Every little thing that could go wrong still has ample time to manifest itself. Why, how, you ask? Because the extraordinary human body can move in any direction in less than .004 seconds, the time frame in which it takes you to remove your hand from a hot stove.

In .004 seconds you can move away from the ball too much, the eyes can look away, the head can move prior to the swing, the wrist can weaken the moment you hit the ball. Pros miss hit all the time, but our hands don't collapse when we do and our swing's strength and determination makes up for it. In .004 seconds you can choke, think about repositioning, think about "if I don't hit it well enough the ball's gonna come screaming back at me." All of this happens subconsciously. But the baddest of them all is...

## **DON'T ROTATE**

Body rotation. Here's the big one. Once the forward swing is initiated, don't rotate. Rotation will cause your head to move, your hand to weaken, will alter the contact point, will send your body away from the ball. If you're more than a 5.0 player you'll rotate some 'cause your racket accelerates well, but make sure it's only some. I know you're following through and thinking about the next shot, and there's a better than even chance you'll rotate a-way from your shot in the present moment. But first things first. Hit your shot, try to chill for 4 milliseconds, then start repositioning.

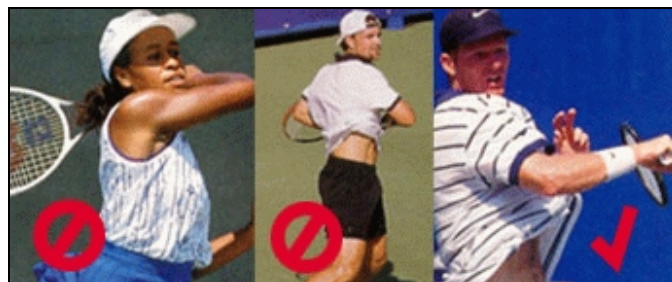
And for advanced players, the slight forward back shoulder rotation that boosts your swing needs to be a subconscious act, not a conscious one. You become terrible inconsistent when you consciously try to rotate part(s) of your body during the swing. If you're having a bad day, try not to rotate as much and it'll help, try watching the ball instead and keeping the head steady during contact. Isn't this why you read about pros hitting millions of balls? Is it timing? Yup, and some days are just better than others.

### **BRING FOLLOW THROUGH AND RACKET FACE DOWN**

To generalize, a follow through finishes with the racket below your chin, facing down either a bit or a lot to your left and above the hand in height above the court surface, and the arm is bent in toward your body. Assuming you want to hit the ball hard and keep it in.



Popular follow through constructs where the forehand's wrist is by your opposite ear to hear the ticking of your wrist watch on that wrist is exaggerated. So, too, is throwing the back shoulder around and finishing with the racket pointed way behind you and down. (Photos from Tennis magazine: Agassi, 11/00, and Haas, 05/00, by Mary Schilpp/clp; Coetzer, 06/98, and Kiefer, 07-08/00, by Ron Angle; Rubin, 08/96, and Courier, 03/97, by Stephen Szurlej.)



The forehand. It's like a shotgun, where you don't have to pinpoint your target (the ball at contact) all that accurately but you can still get it. There's a lot of room for error on the forehand. You can be late and still hit well and you can fight off the effect of going backwards better because you have "more" weight to bear into the shot (the racket arm's behind you and coming forward).

The forehand. A beast. The backhand, by comparison, is beauty. Precision. A bow and arrow. Two handed backhands are more violent than a one hander, they're more defiant, but even they aren't the beasts forehands are.

You're familiar with the pendulum motion, drop your arm by your side and swing it to (down) and



fro (up). Hold a racket in your hand and swing this way and it'll feel very mannered, not natural. That's because it's not natural for the arm to swing a hand-held bat this way. The arm needs to flex.

Step 9 will feature either the backhand or the return of serve, which isn't too involving. I don't know at this time. Until then, good luck, and keep the emails coming 'cause I learn a lot from you, too. Cheers.

# Revolutionary Tennis

## Tennis Instruction That Makes Sense

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### Step 9

## The Backhand Groundstroke

### Part I of II

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mark@revolutionarytennis.com

“Oh sweet mystery of life at last I've found you...”

I doubt lyricist Rida Johnson Young was writing about finding her backhand when she penned her insightful song. But the sweet mystery in everyone's tennis life is the backhand, and yet you hear it's more natural than a forehand, or that its motion is simply like throwing a Frisbee. Hmm.

To solve this mystery you're told to turn (more, more) the shoulders and hips, to lean into the ball, lift up with the legs, step to the net post, rotate the back hip, straighten the arm or extend it to hit, hit out in front, and lift and extend.

You're also told to “slide your racket hand down toward your thigh” and maintain “a rigid hitting arm” when you swing. Or to stroke like “a pendulum” as if you were “bowling with the back side of the hand.”

You try what you're told but it doesn't help your backhand. The mystery remains.

Something's missing, something's not there. You know it, but you can't put your finger on it. Everyone tells you to do the same thing, but why doesn't it work? That's because it's a case of the Emperor's New Clothes. Time for a revolution.

### **STARTING TO UNRAVEL THE MYSTERIES...**

There are two mysteries on the backhand.

1. How the arm works on the stroke.
2. How the body works for efficiency and stroke support.

Let's start this time with the stroke, even though it's the body's attitude that makes the stroke hum.

### **THE ARM FLEXES... IT FOLDS AND UNFOLDS**

Straightening the arm to swing, or swinging with a straight arm, dooms the backhand. The arm is working in a reverse direction than on the forehand, yes, but it still needs to be flexible to retain leverage. On your backhand the forearm “flexes” laterally around the biceps and elbow, a reverse direction from the forehand. After all, this is how your throw a Frisbee, isn't it?

[The word “flexes” is in quotations because this image helps your stroke, and the terms folding and unfolding of the arm help as well. In reality I’m told when the arm is bent and “flexes,” it’s really external rotation of the shoulder, but then if you were to simply straighten the arm and swing away from you it’s horizontal abduction of the shoulder. A proper backhand stroke combines both movements, that of the bent arm (external rotation), and of the arm swinging away from your body (horizontal abduction).]



Photos 1-4, reading right to left, show how this works. In the “racket back” position, your hand is back by your rear pocket, yes, but what is noteworthy is that the arm is bent, or folded, across your stomach. (Two handers could straighten the front arm at this point, though it's best not to because of how it ends up.) Photos 2, 3, and 4 show how the arm “flexes” laterally around the elbow/biceps. The arm is folded across yourself or under your chest muscles in the backswing and then it unfolds for the forward swing.

Photo 4 exaggerates to show how the forearm “flexes” laterally around the elbow/biceps, the issue that is the mystery to the stroke itself. The forearm acts independent of the biceps and elbow and does not work in lock step with them during the forward swing.

Practice this motion yourself right now. Tuck your elbow against your side, bend the arm at the elbow, hold your forearm away from your body at waist level - a typing position -and turn your hand straight up and down. Your forearm is at a right angle to the biceps, the hand is aligned straight in front of the elbow.

Keep the elbow still and move your forearm and hand to your left (for righties), making an arc, stopping it when your forearm is across your stomach or parallel to your hip line. The arm is now folded across your stomach. Unfold it in the opposite direction until your hand is aligned straight in front of your elbow again and then continue moving it past the elbow, while the elbow remains still.

This extra bit of motion shows the (fore)arm's “flexibility” in this reverse direction, it shows how the forearm acts independent of the biceps and elbow and does not work in lock step with them during the forward swing. This (forearm movement independent of the biceps) is how you throw a Frisbee.

[I'm aware when you throw a Frisbee a lot of reverse wrist action is used. This is not analogous in any way to a backhand stroke. There is no reverse flick of the wrist. Only the “flexibility” of the forearm to the biceps in throwing a Frisbee is useful in understanding a backhand tennis stroke.]

The arm does not straighten at all to swing, and it's not a matter of semantics. The arm

straightens when you extend your arm and point “they-went-that-a-way” to the Sheriff.

## UNFOLDING AND EXTENDING

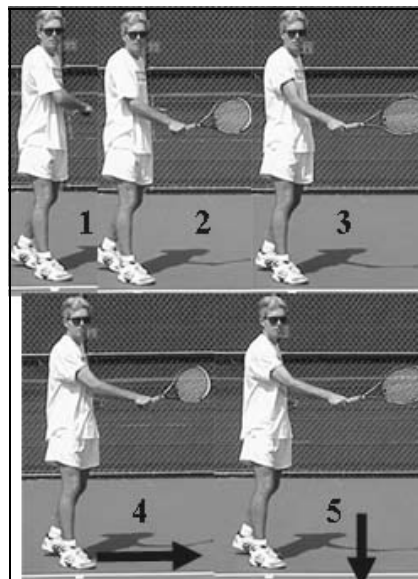
It's not enough for the forearm to merely “flex” laterally around the elbow/biceps on a one handed backhand. The arm reaches out both to your side and in front of you toward the ball, just like throwing a Frisbee.

If you keep the elbow too close to your body, “elbow in,” photos 2 and 3, the arm loses strength at contact for the one handed backhand, though for a two hander this is the position the front arm is in (photos follow). Photos 4 and 5 show how the elbow needs to extend a little from the body toward the side fence for a one hander while at the same time the stroke, or arm, as a whole unfolds forward out in front towards you, the reader (which is really saying towards the ball).

The term “elbow in” means don't stick your elbow out in the direction of the net prior to contact, it doesn't mean keep your elbow close to, or against, your body.

The arm is bent, or bending, when the racket's back, and it unbends when swinging the racket forward, it does not straighten. While at contact the arm can appear to be straight, that has neither been its objective nor the path taken to reach the moment it appears straight.

It is the contact photos of one handed backhands that confuses the issue. It appears, as on the right, that the front arm is straight for a one handed contact. If so, you have to ask, does the arm straighten and then while it is straight you swing the racket, or is the arm simply going to be straight at contact? If the arm is straight at contact it will be as a board, inflexible, lacking leverage. The pop will have left the punch, so to speak. If you straighten the arm first and then swing, well, your common sense should tell you it doesn't make sense. [Clockwise from left top, Edberg by Mel Digiacomio, Tennis Magazine, 10/96; Edberg, L.A. Times, I didn't retain photographer's name; Kuerten as above; Rafter photo by Clive Mason/ALLSPORT, Tennis magazine, 02/00; Henin by Darren England/ALLSPORT, Tennis Magazine, 03/01.]



The arm appears straight in the photo on the left of baseball pitcher Ramon Ortiz as he winds up, and it appears straight on the far right of pitcher Roy Oswalt as he delivers to home plate, but the middle photo (Oswalt again) shows what the arm does in between





those two positions. The arm isn't straightening to do its job, nor does the pitcher “straighten” the arm to throw. [Baseball photos, left, of Ramon Ortiz, by Robert Lachman, Los Angeles Times, 08/23/01; center of Roy Oswalt by Associated Press photo, L.A. Times, 08/20/01; right of Oswalt, Associated Press photo, L.A. Times, 09/10/01.]

Two handed backhands don't have a problem with forearm “flexibility.” The photos on the right of two handed backhands show how a two hander's front arm remains nicely bent at contact and closer to the body than for one handers. It doesn't make sense that the front arm would remain bent on a two hander yet go lock-arm straight on a one hander. What goes for one goes for the other. [Seles photo by Mary Schilpp/CLP, Tennis Magazine, 04/00; Roddick photo by Ezra Shaw/ALLSPORT, Tennis Magazine 07/01; Davenport, USTA newsletter High-performance Coaching, Vol. 3, #2, 01.]



Two handers do keep the elbow in closer to the body than one handers since they're using two arms. And it's easier for them to prevent the front shoulder from lifting at contact. The photos show a two hander's form: front arm bent, back arm straighter, and the back shoulder doesn't dip. [Hingis photo by Ron Angle, Tennis Magazine, 11/99; Moya photo by Ron Angle, Tennis Magazine, 9/99.]

Two handers often seem to straighten their arms when they draw the racket back, but at contact the front arm is most definitely bent. This means both arms have “flexed,” or bent, during the forward swing. Again, keep both arms “flexible” during the swing, avoid straightening either one. [Hewitt photo top by Raveesh Whorra/NAV.TN, Tennis Magazine, 03/00, bottom by Richard Osborn, Inside Tennis, oct/nov 2001; Hingis cited above.]



Close readers will remember the curious revelation in Step 8 that on a forehand the racket face first opens then rights itself for topspin contact. That is the hand naturally supinates during the forward delivery of the stroke, only to pronate prior to contact and continue after.

The same happens on a backhand. The racket face first opens on one handers, only to close before contact. But here it's pronation first then supination. It's not a big deal, it just helps explain why we change grips and why the ball flies on you even if you have an eastern backhand grip - the wrist pronates (opens) at contact.



## THE WRIST...ON THE BACKHAND?

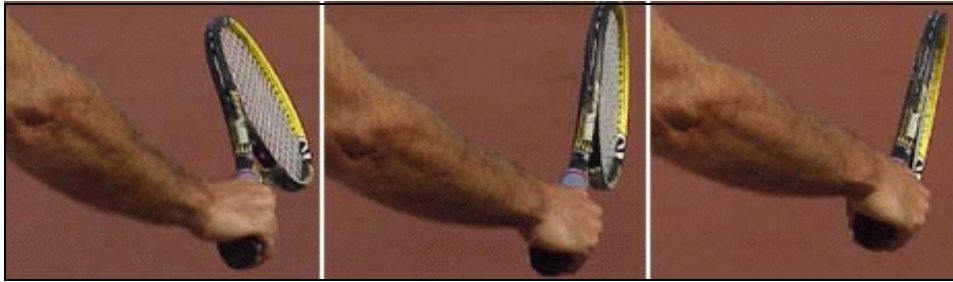
Is the wrist used on the backhand? Of course it is. It's our dirty little secret.

Take a breath, calm down, and put your eyes back in their sockets. And if you're a tennis literalist, don't read any further.

Rod Laver talked about using his wrist on his backhand, and the phrase “turn of the wrist” is



found in old tennis books. You lock the wrist at contact, yes, it stays that way. And you don't "wrist it" by any means, you don't break the wrist from 9 o'clock to 3 o'clock. But by rotating the wrist prior to contact as if you were tightening a screw you alter the angle of the racket face for contact. The photo sequence below illustrates this adjustment procedure, and you choose what you want.



The wrist is the point of least resistance on all strokes, and on backhands it's especially weak because the hand breaks back, or inwards, against itself unlike forehands. To prevent this you could adopt an extreme eastern backhand, which is like holding your racket with a forehand grip and then using the same side of the racket facet to hit a backhand.

Sounds like a problem solver, but changing your grip like this creates problems, too. The problem is it becomes harder to get the head of the racket around to make contact ahead of the hand. The ball's at an angle, remember, and to hit it head on the racket head should be ahead of the hand, when viewed from the side. Using an extreme grip leads to hitting the ball with inside out spin. It takes extraordinary hand strength, and athleticism to make this work.

An easier way to get the racket head around first is to avoid the extreme backhand grip. The ball may pop up on you but if it goes straight that's a good sign you're getting the racket head around well. To avoid the pop up, adjust the angle of the face at which the ball hits the racket. You can change the grip slightly, though not extremely, and/or rotate the wrist and forearm clockwise during the forward swing.

In order to bring the racket face around while the arm both unfolds laterally around itself and extends, or expands, laterally around the body, the wrist has to help out. Sometimes the wrist starts moving the head of the racket first (and then stops) before any part of the arm begins to unfold. Sometimes the wrist dramatically brings the racket face into the ball right before contact, often done when the player has been indoctrinated in straightening the arm first for the forward swing.

## **WRIST KINEMATICS IN THE BACKHAND STROKE**

From the August 1998, ITF Coaches Review (International Tennis Federation).

In this study the authors investigated the wrist kinematics (flexion/extension), grip pressures and wrist muscle electromyographic (EMG) activity in novice and expert tennis players performing the [1 handed] backhand stroke. Results showed that expert players hit the backhand with the wrist extended (neutral alignment of the forearm and hand dorsum) and that their wrist was moving into extension at impact. In contrast, novice players struck the ball with the wrist more flexed while moving their wrist further into flexion. Expert players also displayed greater wrist extension in the follow through. Novice players eccentrically contracted their wrist extensor muscles during

impact which may contribute to lateral tennis elbow.

*Blackwell, J.R. & Cole, K.J. (1994). Wrist kinematics differ in expert and novice tennis players performing the backhand stroke; implications for tennis elbow. Journal of Biomechanics, 27, 5, 509-516.*

Commentary. Bending your wrist inward is called flexion, bending it backwards is extension. Notwithstanding just who and how "expert" the "expert" tennis players were in this study (6 collegiate tennis players) it notes how the wrist is not held immobile or locked during the stroke but "was moving into extension at impact." That is the wrist was moving in the backwards direction. The novices moved their wrist inward even prior to contact and then some more at impact. Hence the wrist is to be used correctly on one handed backhand strokes.

The point is the teaching establishment feels none of this happens, or even should happen, in a backhand. But **Revolutionary Tennis** wants you to experience the freedom that comes from tapping into your body's natural gifts as so designed by a higher power. To instruct a backhand stroke that restricts and limits you smells like fundamentalism. Tennis freedom is a good thing.

Two handed backhands use a variety of grips on the front hand, but the back hand is the one that's the boss during the forward swing. The back hand's wrist plays a part in helping start the swing similar to the way the wrist is used on the forehand.

As an interesting aside, I participated in a tennis elbow study in 1987 for Dr. Michael Morris at the Kerlan-Jobe group at Centinela Hospital here in Los Angeles. They reported in their paper "the highest muscle activity during the [forward phase of both] groundstrokes was in the muscles that control the wrist." And in one of the establishment member's own backhand Ph.D. thesis, it's noted how there is a larger amount of wrist angular acceleration and displacement in a one hander than a two hander.

A dirty little secret it is, but I'm not going to tell you about it if I teach you. Even when you're not hitting on time. Why not? First, it's a measure to be used as a last resort only if you're doing everything else right. Second, it's very likely you'll do some of this on your own in your own way. And third, it's a delicate movement, like holding a butterfly by its wings.

You first need to control the use of your arm, keep it in, unfold it well, lock your wrist, get the head of the racket out in front, look at the ball well. You can't fix your timing by using your wrist, you'll just snap it backwards into the ball and you'll hate it.

### **ABOVE ALL ELSE, TRUST YOUR INSTINCTS**

Two reasons why the backhand's mystery continues is because either you're offered a flawed how-to form or the instruction ignores the little details that add up to a heck of a lot. Visual imagery is a major learning tool, but this powerful tool becomes corrupted when the images you follow are flawed or overlook details that are enormously helpful.

In Tennis magazine on the right, as an example, if you compare Jack Groppel's form with the pros above, many things are amiss. His back arm



is bent and not the front arm, his front arm is the straighter arm and not the back one, the back shoulder dips, the front arm and hand are down like a pendulum, and his front knee leans out past the front foot. After seeing this image in a how-to section you will try to imitate it, yet nothing from it is helpful. [Groppel photo by Caryn Levy, Tennis Magazine, 02/95.]

The point is, you see this, you absorb this, but somewhere in the back of your mind you're thinking, "yeah, all right. But..." You feel something's missing, it's all not there. You're right, you're absolutely right. You need to trust your instincts.

You need to listen to that little voice inside your head that talks to you about tennis form. It's most always correct, no matter what anyone else says.

Which takes us to...

## **THE LITTLE DETAILS... THAT MEAN SO MUCH**

Now **Revolutionary Tennis** breaks new ground in how the body works for efficiency and stroke support on a backhand. It's a lot of fun, and hopefully it makes you go, "Hmm, that makes sense," and, "Yes, I can do that."

Why is your forehand stronger and easier to hit than your backhand? Because your forehand works with your dominant side, while your backhand works with your non-dominant side. And with that a whole bunch of stuff just comes together all by itself: You move better, see better, balance better.

Athletes favor one side over the other, and are always stronger when coming at you from their dominant side. Strong side, weak side; dominant, non-dominant.

Which begs the question: how can you make your weak side work like your strong side? It's simple. You apply a symmetrical, or mirror, image from your strong side to your weak side.

## **SYMMETRY**

This idea of applying the feet, the body, and the eyes in symmetrical fashion from forehand to backhand does not exist in tennis, until now. And this is what eliminates the weak backhand. It's wild.

## **FOOTWORK**

Step 2 introduced the concept of symmetrical footwork for precisely this reason, to empower the backhand. In fact, preceding Steps show how it is the back foot that first moves you, it is the back foot that keeps you moving in a forward direction, the back foot gets you close to the ball, the back foot holds your balance, the back foot prevents you from stepping across and/or turning sideways, the back foot directs your body's momentum into the ball for power.

In short, the back foot rules. And on forehands the back foot is your dominant foot. The strong side. Nice coincidence.

But on backhands this coincidence doesn't exist. On backhands the back foot now coincides with

your non-dominant foot, the weak side, and the back foot doesn't rule because it's not used to being dominant. Instead, and mistakenly, your dominant foot (the other one) assumes the role.

No wonder everything feels so different. No wonder you often move to the side fence, are slow, wind up turning your back to the ball, lose your balance, get miss-hits, hit with no power.

On forehands you move normally because the back foot moves normally, but on the backhand the back foot drags behind the front one, it doesn't step forward normally. Mistakenly on backhands the lead foot (front foot) steps, the trailer (back foot) drags.

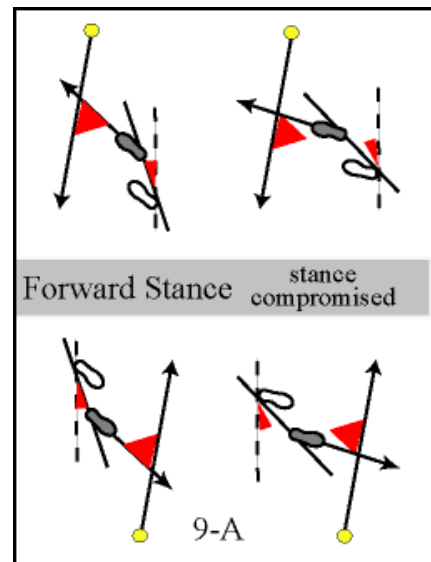
The back foot on the backhand must become the “dominant” foot on the stroke. It takes you to the ball, it holds your balance, it prevents you from turning sideways. It covers distance, not the front foot.

All you have to do is follow the footwork pattern outlined in Step 2 to train your non-dominant foot and empower your stroke. It'll be a little clumsy at first, but it's not difficult to do or a game-changing thing.

### THE FORWARD STANCE

Step 3 showed why strong forehands result from the Forward Stance. If so on a forehand, why not on a backhand?

In diagram 9A, the left half shows what the Forward Stance looks like for a backhand, and the right half shows the common weakness for us all, stepping across. The bottom half is merely a flipped version of the top because you often see the pros from this perspective. When you step across the angle of the feet relative to the ball's flight line means the player has not been moving forward into the ball but off to the side. Without the body's momentum going into the ball, the contact will be less than stellar.



When you step across the stance itself becomes too narrow, and your base of support is undermined. A too-narrow stance never happens on a forehand. Stepping across results from both by a poorly used back foot and adherence to the teaching mantra of “turn, turn, turn.”

This is what footwork is all about.

On the right, Agassi and Kafelnikov are in the Forward Stance, but Hingis is stepping across. Too often your feet step across like Hingis', and the stroke starts with two strikes against it. [Agassi photo by Stephen Szurlej, Tennis Magazine, 03/96; Kafelnikov and Hingis photo by Mary Schilpp/CLP, Tennis Magazine, 12/97.]





Look at the following four photos by the well intended and always on-the-money Nick Saviano. In photo 1, left to right, his feet look like they're in the Forward Stance, both pointing at and forward into the ball without stepping across. In photo 2 the front foot is definitely stepping across, in photo 3 it's not as pronounced but the feet are definitely disparate, and in photo 4 they're merely disparate though he's not stepping across so much, if at all. More important than Nick's stroking advice is the angle of his feet relative to each other and to the ball. [Tennis Magazine, 05/96, photo by Caryn Levy.]

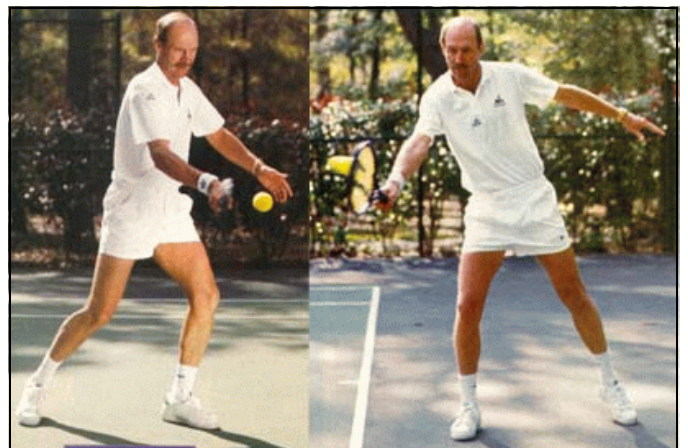


Another head to head example helps to show how this little thing with the feet slips by everyone. Both Brian Gottfried and Stan Smith extol the virtues of hitting the ball out in front sufficiently for a strong backhand. That part is true, but notice how little notice is given to the their foundation, their feet. Smith has his feet turned sideways, leaving the contact spot outside the width of his feet and thus unsupported, while Gottfried has his feet in the Forward Stance, pointing at and into the ball. Those feet spell success or failure. [Gottfried photo by Fred Mullane, Tennis Magazine, 08/98; Smith photo here and below by Fred Mullane, Tennis Magazine, 06/96.]



If you don't believe it, perhaps a comparison between Stan's forehand stance and his backhand stance will further advance the argument for symmetry. His forehand stance shows the Forward Stance, both feet are pointing at and into the ball, and great balance, but the symmetrical view isn't there on his backhand.

This is what footwork is all about.



Often you'll see a hybrid with the feet, which I call disparate feet. One foot's pointing one way, the other another. The back foot will be sideways, or parallel to the baseline, indicating the prior direction of movement, but the front foot will open remarkably to the ball and may even point perpendicularly to the net. The pro does this to save the day. If not, by stepping sideways, the contact spot will lie outside the width of the feet, Step 3. But why not plan better so you don't have to complicate things at the end? [Wilander photo by Stephen Szurlej, Tennis Magazine, 06/96; Svereva photo by Michael Baz, Tennis Magazine, 12/91.]





## WATCH THE BALL THE SAME WAY

Vision. On a backhand you'll turn your head to the side much more than on a forehand because either you turn too much anyway or your arm turns you when you take the racket back. The result is you won't time the ball well if your vision is impaired. You have to really work at seeing the ball well on the backhand, you have to open your own face to the ball.



There's a popular and oft repeated tip that if your opponent could read your name printed on the back of your shirt you've achieved a good turn of the shoulders when taking the racket back. Well, you might really be turned, but with your head turned so much you won't be able to keep both eyes looking straight forward at the ball. What, then, to do? Why, develop the world's most flexible neck and shoulder, which Gustavo Kuerten remarkably displays on the right. Yikes! [Tennis Magazine, 12/00, photo by Brian Bahr/ALLSPORT.]

The fact some pros appear to be doing this is a tribute to their body's flexibility, a flexibility developed since age 5 or 6 and enhanced over hours of practice. So don't turn your back. Instead focus on looking at the ball well, Step 7, start the process of taking the racket back, and the turn will take care of itself.



In the Hingis series above you can see how she counter turns her head to her torso's own turning to clearly see the ball. Or you can say she keeps her head facing forward as her torso's turning. [Tennis Magazine, 11/99, photo by Ron Angle.]

## BALANCE AND BODY WEIGHT SHIFT

Step 5 illustrated all the components to proper body balance. Neither your head nor shoulders extend past your feet when viewed from the side or the front, as defined by the black vertical line. This comes easily on forehands, but not on backhands.



Here are the photos of Gottfried and Smith again with a line drawn showing how Smith's leaning over too much, he's off balance compared to Gottfried. The line has been placed right on the front toes.



If you keep your posture, balance, and stance like Brian Gottfried, chances are excellent your stroke will be strong. This requires you to lean back a little bit since the tendency on backhands is to keep your body weight on the front foot instead of the back one (again, the back foot rules).

As stated in Step 5, balance is: “The torso and head are back when the body center moves first. The upper body appears to float above the lower body, with the lower body doing the most work. Unencumbered by having to counter any imbalance, the lower body and midsection can then provide maximum support to the arms. The end result is the strongest foundation possible when hitting or striking. Power.

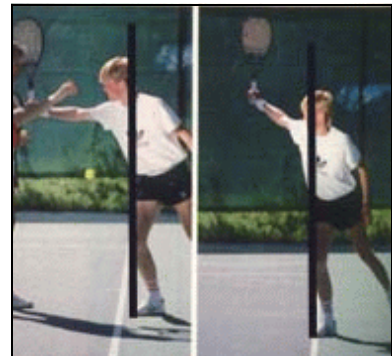


A **Revolutionary Tennis** reader pointed out how that last statement clarified for him Don Budge's backhand stroke as seen on a tennisonline.com video clip. The reader wrote how he felt Budge moved “too stiffly. Little did I know his floating, well-posture, erect vertical body movement was the key to his power not the diagonal arm movement he borrowed from his baseball experience.” [Budge photo Tennis West, 5/21/98, photo International Tennis Hall of Fame.]

Don Budge was a master. Even though on the tennisonline.com clip he is not moving forward into the ball, he had great heart, great strength, great vision, and above all, a great gentility. With his thumb up the handle to produce his feared topspin, no wonder his follow through was so exaggerated. But his playing elegance indeed showed his mastery over his body's balance.

Body balance is a simple thing, but too often you don't see this in how-to articles. And what you see, is what you'll do.

Dennis Van Der Meer instructs how to “step forward and lean into the shot” so you can “hit it a ton,” Tennis magazine, 11/88, photos by Dom Furore. The model “leans” into the shot like Dennis wants him to, but he's way off balance in the first one, and still off balance in the second, which shows this little but most important detail that defines your body's strength has been completely ignored. The model's feet are right-on in the Forward Stance, but this seems to be merely a coincidence because the whole package isn't coming together.



In the next photo, both the Van Der Meer student and Tennis Magazine's 101 tennis tips model are off balance as well. Though the feet are good on the left and passable on the right, the balance is off. On the left, ignoring the harmful imagery of the stick-straight arm, the right hip and buttocks stick out to the rear, and the head is turned way, way too much to the side. On the right, well, it's obvious. [Van Der Meer male student, left, Tennis Magazine, 07/00, photo by Peter Lamastro; 101 tips model, right, Tennis Magazine, 10/99, photo by Caryn Levy.]



The solution to the high bouncing ball on the left, by Van Der Meer, though not alone, advocates keeping the body farther away laterally from the high backhand ball so you can straighten your arm and swing away. Of course, straightening the arm denies its leverage capacity, but “as you make contact with the ball, straighten your arm” has been the common mantra on all tennis backhands.

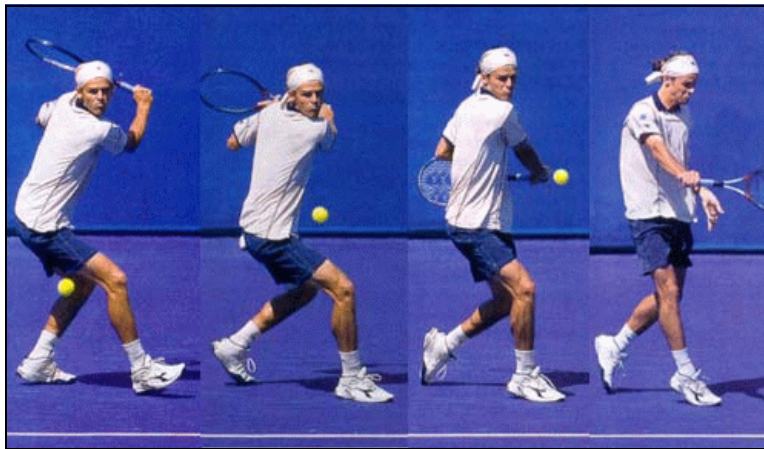
What's hard to do on a high backhand is NOT keeping the body away from the ball in a lateral direction (toward the side fence) but keeping the contact spot in the forward direction (toward the ball, or net) to allow the arm to unfold in that same direction as seen above (photo 5, Unfold The Arm). We all tend to hit the high bouncer late because our eyes bring the ball in too deep before we think about hitting it. Hit the high bouncer sooner so it doesn't smother you. The solution on high balls is to get closer, laterally, as seen in Step 7, to keep the feet in the Forward Stance, and to reach out in front “more” in the direction of the ball (or net).

## BALANCE ON A BACKHAND

On a forehand your arms spread out on either side of your body when you move and prepare the swing, sort of like you do when walking a line. But on a backhand you are imbalanced from the get-go. Both arms are on the same side of your body and you are constantly losing your balance. You lean over, bend at the waist, and get in a crouched position before swinging, all of which are counter productive. And you still lose it on the forward swing since the arm swings away from the body altogether.

Even two handers easily lose their balance. What to do? Watch Gustavo Kuerten's magic.

Yes, Kuerten seems imbalanced, his back seems to be “facing his opponent,” and his back foot is turned too much to the side. It is a testament to Guga as the perfect student that he displays what the establishment has asked him to, and it is a testament to Guga's superb athleticism that he has developed techniques to help compensate for their inherent inconsistencies, one of which is his extraordinary neck and shoulder flexibility seen earlier. [Tennis Magazine, 04/01, photo by Ron Angle.]



Guga could remain imbalanced (leaning over/butt sticking out), but witness how his torso changes its position/angle over the lower body. At first the torso's a bit hunched over the lower body, a result of turn-turn-turn and disregard for the back foot, and then the torso rights itself above the lower body as the lower body's weight shifts onto his front foot. While Guga's lower body continues its forward journey into the contact his upper body has gone in the opposite direction to achieve balance. This is his compensatory technique, he pulls that torso back, and his head, too, before he swings the racket.

Most players continue their hunched position into the shot, but Guga achieves a strong backhand by not doing so. Guga's upper body appears to float above the lower body, allowing the lower

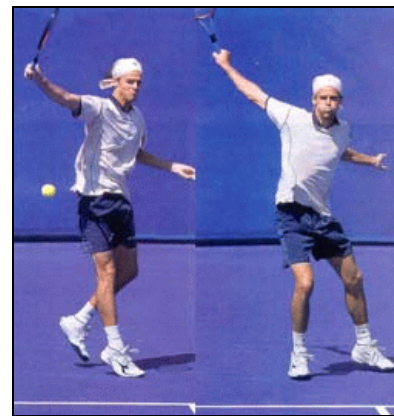
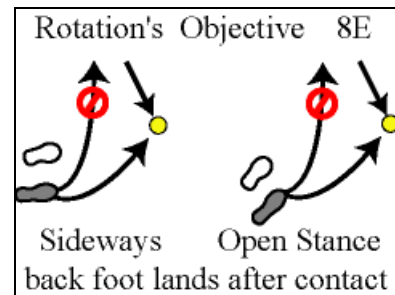


body to do the most work.

Shifting your body's weight to empower the stroke means shifting it into the ball. This weight shift is linear, not rotational, for the same reasons as explained in Step 8, The Forehand, and Step 4, Your Power. This linear movement for your body's power source is a small movement, and as with all things small that make a big difference, it often gets lost in the shuffle. It isn't even recognized on the forehand side, where large body rotation is, which is why I guess the "lean into the ball" business developed for the backhand.

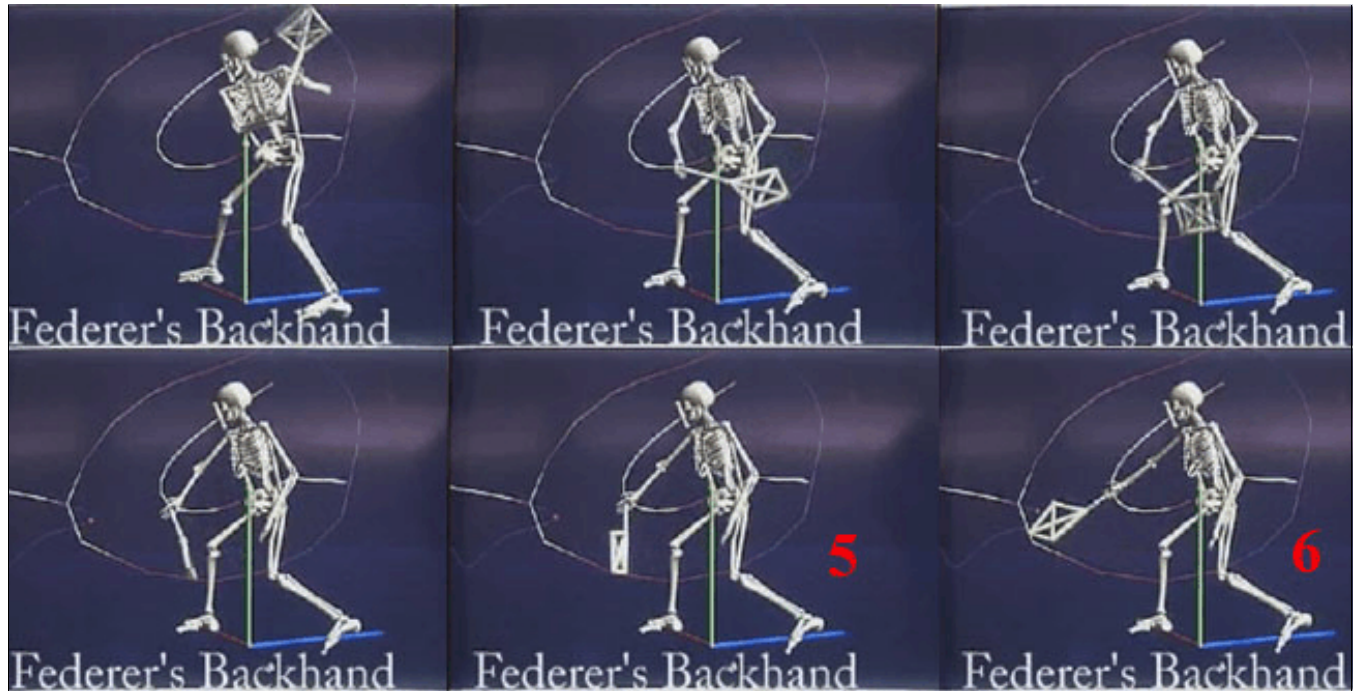
Guga's last two photos illustrate how to compensate when your body weight isn't going forward into the ball 100%. He is too turned, remember, his body center isn't going precisely forward into the ball/contact and he's going to have to re-align himself. How to? Rotation. As shown in 8E, body rotation is tolerated when the back leg swings around to embrace the contact spot and not when it swings around to the net.

When the back leg swings around to embrace the contact spot it does not step more forward into the court than has the front foot. Guga's back leg is in the process of coming around during the the forward swing to help align his body's power (body center) with the hit, and this back leg does not wind up farther ahead of the front leg into the court after the hit. This swing-around of the back foot during contact when you're turned too much to the side prior to contact produces excellent results only when it's gentle and doesn't step toward the net and ahead of the front foot.



## FEDERER BACKHAND DIGITIZED LOOK

The following link [tennisone.com/club/lessons/braden/backhands/bh.free.php](http://tennisone.com/club/lessons/braden/backhands/bh.free.php) offers a free vidclip of Federer's and Clijster's backhand with the added instructional bonus of the players and strokes rendered in digitized form, or stick figures.. This timely evidence of how-to regarding Federer's one handed backhand is offered by Vic Braden via the Ariel Performance Analysis System, or APAS, and we all should thank him for this.. The photo sequence below taken off this vidclip shows how Federer's arm starts out bent, or folded across his stomach, and as the racket progresses to the contact spot the arm in effect unfolds, or unbends.. In this example, as well as in many others, the arm clearly does not straighten to swing.



I know for a fact Vic would say he has groundstroke shots of Federer with a slight bend in the elbow as well as shots with a fairly straight arm, and that Federer's choice for these different approaches is an interesting question open for answer.. I'm sure you all would add it depends on the situation, the shot, the spin, the time, those kinds of things, and you'd be absolutely correct, but the thing to note is we can have both endings, slightly bent or fairly straight, and yet each Federer backhand clearly begins with the bending, unbending arm.

It is crystal clear here the arm is bent and unbends throughout the stroke.. In no way does Federer straighten his arm to swing the racket down or up into the ball from the nadir of the swing, and neither does the butt cap go straight to the ball.. This evidence confirms **Revolutionary Tennis'** description how the arm works to produce this stroke.

But there is much more here to enjoy.. When you view the clip for yourself you will see many things, including an interesting twisting of the racket, validating wrist movement.. But a large gem shown in the stills above uncovers the cornerstone to all one handers, either flexible like Federer's or straightened like Robredo and Gasquet: the hand turning the racket face into the ball, no matter if you hit up the line or crosscourt.. Photos 5 to 6 the body remains the same and the arm has moved imperceptibly, but what has occurred is the racket face has been turned into the



ball (as pros call it).. Dramatically.. How?.. The hand is responsible.. The shoulder does not swing the racket, the arm does not swing the racket, it is the hand doing the heavy lifting throughout to ultimately turn the racket face into the ball.

In this manner all one handers share the same element - the hand turning the racket head into the ball - and it's a process that's being setup from the beginning.. Some may actually straighten the arm to swing the racket or straighten it halfway through the upward/forward swing itself while retaining stroke fluidity as you see in some pros (giving the false impression the butt cap or a straight arm plays a central role), but this places a heavier load on that final turn than does retaining flexibility in the arm.. As a teacher I try to counsel arm flexibility instead of rigidity for this, and as a player I never try to straighten, or even think about straightening, the arm when swinging at the ball.

If you have a severe backhand grip, like Robredo, or Kuerten, that is the hand is really behind the racket handle unlike Federer, this will force the arm to straighten in order to turn the racket face into the ball.. Is this a better way to do it? In my opinion it's not, the demands and limitations for execution increase even more.. If a student evolves into that grip position then it's inevitable the arm will straighten during the swing, but if that same student is looking to improve some advice would include either moving away from that grip and learn to use the wrist to achieve the same purpose or think about being a touch more flexible *in thought* with the arm instead of going rock-rigid-solid throughout the stroke.

## OLD THINK

- turn
- turn sideways
- turn your back
- crossover step
- step across
- keep arm fixed
- lean into the ball
- pendulum swing
- straighten the arm(s)
- rotate, angular momentum from the body

## NEW THINK

- arm folds and unfolds
- “flex” the arm(s)
- do not straighten arm(s)
- body symmetry, make it just like the forehand
- forward stance
- posture, keep head and chest back
- linear momentum from the body

# Revolutionary Tennis

## Tennis Backhand Instruction That Makes Sense

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### Step 9

### How To Help Your Backhand

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mark@revolutionarytennis.com

A)

IF you improve your rhythm by improving your locomotion pattern,

AND improve your timing by improving both your vision and balance techniques,

You'll hit the ball with more power, but you'll lose control.

B)

TO improve your (stroke's) control,

Your grip needs to be firm AND the arm(s) needs to be relaxed during the forward swing. This means the arm(s) bends and unbends, or folds/unfolds, during the back/forward swing. You also can't overswing or overdo or use techniques which try to compensate for the body being incorrectly structured, which means no straight-arm, extend-an-arm, Inspector Gadget-arm, or pendulum bowling-arm here.

C)

THE final piece of the puzzle is:

### **FOLLOW THE YELLOW BRICK ROAD**

Trust yourself. First. You know you can do it on a forehand, but there's doubt on the backhand. When your body works in just-the-same-way on the backhand as on the forehand you'll sing, "Bye, bad-backhand."

Strong backhands, as forehands, are based on the universality of how the body moves and structures itself for power (as outlined by **Revolutionary Tennis**) married with tennis' reality of a ball angling away from you.

So much for the good news. Now for the bad news. This new backhand of yours is going to take some time to wrap your arms around. At first it's gonna feel awkward, moving unlike you're used to, balancing unlike you're used to, watching the ball differently, trusting the whole thing and yourself. Why awkward? Because you're no longer compensating or being lazy, sort of like learning to walk or stand with proper posture

How much time? I don't know. Generally speaking, if you play twice a week it will take you -

I'm guessing - 6 months. But then that's all related to the level of your input, and how well you're willing to take two steps back before catapulting forward. It may take you less time, it may take you more. Who knows. Does it matter? Not really. It's the process that counts, knowing you are on your way.

There are four natural weaknesses with both one and two handed backhands. These are:

1. Footwork. See Step 2.

You cross over step first (arrhythmic when planning to hit off the front foot).

The angle of approach is too much to the side fence (momentum not headed into the ball/supporting the stroke at contact).

The steps are not complimentary (third step is a shuffle step and not a step past its predecessor)

You don't move heel to toe.

The last step isn't at and into the ball but turns sideways or steps to the net.

2. You're sideways. See Step 3.

"Turn, turn, turn" leaves you in a sideways position relative to the ball and not in the Forward Stance. When sideways your body does not support your desired contact spot "out in front," instead it will support one much later.

3. Your head turns. See Step 7.

You don't see the ball well in 3 dimensions. You miss-time the ball when your eyes give your brain the wrong data on which to time your swing.

4. Loss of balance. See Step 5.

Inherently you are out of balance, unlike a forehand. And during the swing you naturally lose your balance as well.

Additionally

- two handed swings dramatically twist/rotate the upper body inward and away from the ball.
- one handers need to stop farther away from the ball than expected to allow for the swing.

So I guess on a backhand your feet get crossed up, the whole method makes you lose your balance, your vision is impeded, you don't support the contact, and the swing, well, the swing just doesn't know what to do. Hey, let's be positive. At least we've ID'd the problems. There are solutions.

## **FOUR WEAKNESSES AND TWO SOLUTIONS**

Footwork, per Step 2, allows for rhythm of movement and efficiency as you experienced on the forehand. The back foot moves you rhythmically and efficiently into the ball. On a backhand that means counting on your non dominant foot to do this for you, but this is a role it's not used to.

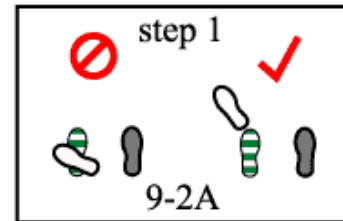
Footwork will prevent you from turning sideways and will make sure your body supports your stroke. Fuggheadabout "turn, turn, turn." There is something to "turn" later, but it's done after you've begun moving, not before and not as part of your movement, and it's a small ingredient, not a be-all, save-all thing. (That something to turn is the front shoulder, and it's turned about when you're two steps away from the ball, way after you've begun moving.)

Don't turn that mug of yours too much to the side. As soon as you've moved to the ball and begun the process of taking the racket back, your head has already turned enough laterally. Concentrate on keeping the head still when moving, track the ball more laterally than with the eyes, and reference the contact spot.

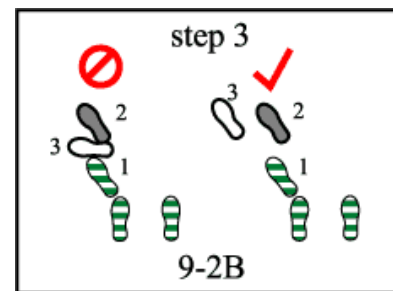
Watching the ball well helps with balance. Both the racket and arm(s) are hanging off to your side in front of your stomach, and you'll lose your balance. Keep your own head and torso back and you oughtn't lean over then. Prior to contact keep your body's weight on the back leg.

### LET'S BREAK IT DOWN

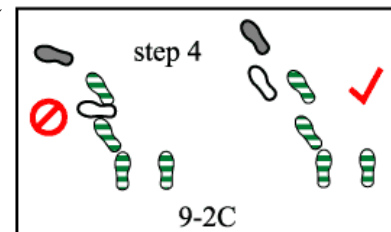
Pick up your feet. Get that back foot to move first and forward into the ball, 9-2A. It's difficult at first, but this is the first stage to a strong backhand.



Keep the feet moving both into the ball and complementarily. You can move the feet complementarily but if not forward and into the ball the stroke/contact spot has no power due to lack of support from the body. Make sure step #3 is a step past #2 and doesn't turn and do a merengue step into the front foot, 9-2B. Merengue!



Your last step needs to be at and forward and into the ball, not off to the side where you'll wind up with your feet spread apart (and sideways), 9-2C. You never spread them out like this on a forehand, unless you do what the establishment calls a "closed stance," which is sideways, a no-no, hence the development of the open stance.



### RACKET BACK FIRST?

No, you move first. As with the forehand, "take the racket back" is a process. Only during a lesson when developing muscle memory will you literally "take the racket back" first and then move.

Martina Hingis shows this process. She's moving, taking steps, then taking the racket back fully just before the forward stroke.



You can "turn" or curl the front shoulder a little more than what's comfortable (Martina picture

above #3) when you're two steps away from hitting the ball. When "turning" the shoulder at this time it won't throw the body into the wrong direction, whereas if you "turn" from the get-go you're off to the side fence.

When the racket's back, notice I said "when," you should carry the racket hand waist high. This ensures your arm bends, or folds, like it's supposed to. If the ball's low or high, you still do this, one or two handers.

Okay. You've moving all right, and you're getting the racket back, and you're seeing the ball well. Now what do you do, you ask.

One handers have to stop farther away from the ball than on a forehand. Two handers don't have this problem. You need to plan for it, and not lose your balance over it (well, you actually will, so plan for it).



There are plenty of photos that show a backhand's contact is "farther out in front of you" than on a forehand (photo far right). But the contact on a one handed backhand is also farther away from the body laterally than on a forehand, shown by the tennis balls in the other two photos to the right. By the way, my arm is not lock-arm straight here.



When one handers swing, since the racket and arm move out away from you, you're gonna lose your balance (again!), so plan for it.

When two handers swing, with the extra torque two hands and arms provide you'll literally pull yourself away from the ball, and, guess what happens.... You lose your balance. Again. Solution? Keep your upper body and head back, and don't let the swing uproot you.



## **DON'T LEAN INTO THE BALL, DON'T BEND OVER**

Keep your weight on that back foot. Keep your body weight back. Sure, when you're moving forward to the ball your torso will be leaning over, but that's when it's time to say, "whoa, nellie!" Pull back. Pull that torso back, keep it upright, like Guga (and Hewitt) does so splendidly.





It's possible that even though both feet point at and into the ball on the stroke, the knees and hips can point inward, away from the ball, compromising the body's support. This happens to me. With my front foot pointed into the ball, my front knee turns inward, toward the back foot, as does my front hip. I have to consciously open these to match the alignment with the front foot.

Shift the body weight into the ball, which means on an angle with regard to the court surface below you and NOT to the net, NOT in the direction of the ball's placement.

Ah, and now the swing. I can feel you're choking already. #S&\*! A strong backhand, like your forehand, is all about a process.

- movement
- + direction
- + stroke preparation
- + vision
- + balance
- + the Forward Stance
- + self discipline @ stroke time
- = a strong backhand.

Notice there's nothing there about keeping the ball in, it's all about a strong backhand. And that's what you've got to come to grips with, that you have a strong backhand. Once you realize that, two things will happen. You won't choke, and the ball will come in.

### **HIT THE BALL ON TIME - USE WRISTS**

Every stroke is about putting the strings on the ball on time, which often means the racket head is out ahead of the hand. The backhand is no different, the hand(s) swings the racket head.

When you swing the racket, in order for the racket head to get from the backswing position to "out in front," the front shoulder won't really move, the biceps doesn't swing out toward the net, the elbow doesn't stick out toward the net, and the hand doesn't extend out to the net. Why? So the racket head can get into position.

On one handers the arm unfolds during the swing, or, to use another term, the arm sweeps across the court (a grand gesture) out to the ball all the while making sure the elbow and biceps don't head out to the ball first. If, however, the racket face doesn't contact the ball on time and send it crosscourt sweetly, I discretely ask you break the wrist ever so gently to get the racket face moving first when it first starts its forward swing. This isn't a wristy kind of a thing, nor does the wrist move as much as it does on a forehand. It merely is a suggestion to experiment with.

There is no sweeping motion for two handers since the arms remain in close to the body.

But I am noticing two hander students tend to keep both wrists literally locked during backswing and forward swing. And this inhibits performance. After I recommend that a student "relax the wrists" during the backswing and forward swing the student often hits better. Relaxing the wrists helps take the racket back, and "relaxing" doesn't mean the wrist is loose like cooked spaghetti.

No, you're in control of the wrists. Since a two hander is often interpreted as a forehand using the non dominant hand, since on a regular forehand the wrist is used, why not when a two handed backhand?

### **UNLEASH IT - BANG IT**

You swing fluidly, or maybe not so fluidly, on your forehand. Regardless, you feel confident on the forehand and you bang it. Why not on the backhand? Bang it, man. Set yourself up and then bang it. But it's a different banging, a different animal than the forehand. The forehand is more like a shotgun, the backhand a bow and arrow.

Ball goes out? Reign in the stroke, but not the fluidness, not the full, free stroke. Reign it in by not swinging across, not swinging up to the sky, by not opening the racket face at contact. Do what it takes to prevent the racket face from opening at contact - supinate the hand, change the grip, angle your wrist.

### **CHOICES, CHOICES**

Now with your new backhand you'll have to decide: to slice, to top, what shall I do? Two handers can do the same thing all the time, but one handers need to choose. If the ball is chest high and above, a slice is generally the preferable choice. When lower than that, you can both slice and top. But decide before the ball's bounced on your side or you'll confuse yourself, which doesn't make for a pretty shot.

The secret to hitting strong backhands has already been covered in earlier Steps. Footwork, movement, balance, vision, all lay the foundation, just like on the forehand. Adjusting for the ball's different approach direction to you is covered in Grand Unification Theory. If you've understood how this all works for the forehand, merely flip it over, like a mirror image, and apply it to your backhand. Of course the stroke's a little different, in some respects, but the objectives of hitting on time and through the middle of the ball remain the same as on the forehand.

The hardest thing on the backhand is keeping the arm quiet in the beginning of the forward swing to start the slow process of getting the racket around without moving the front shoulder or rotating the torso. Backhands are harder to adjust at the last minute than forehands for precisely this reason. The stroke is more committed at an earlier part in its forward swing because the arm extends out to, rather than compressing into, the ball.

My own personal checklist on a backhand works like this. Front shoulder turned or curled, head open and steady, torso upright, back knee turn in, front knee opened, weight on back leg, stay away sufficiently, sweeping motion, figure out the wrist and hand angle, use eyes to glance at ball.

That's about it. If you felt there should be more here, remember that at the end of The Wizard of Oz the Wizard himself is revealed to be mortal. Same with the backhand. Don't be intimidated. The solutions, delivered in earlier Steps, are already known to your forehand (footwork, movement, forward stance, balance, vision), and are ready to be implemented by you.

Next up will be either volley or return, or both.

# Revolutionary Tennis

Tennis That Makes Sense

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## Step 10

### The Volley: Sweet Thing

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mark@revolutionarytennis.com

#### **TIME AND SPACE, THE FINAL FRONTIER THESE ARE THE VOYAGES OF THE TENNIS VOLLEY**

Established volley technique is nothing short of bigotry. And foolishness.

You turn the shoulders, you keep the racket head above the hand or at a 90 degree angle to the wrist, you take one step, lock the wrist, hit out in front and slice down on the ball. Foolishness, all of it.

Take the ready position in this three part photo. The photo on the left shows the three options up at the net, you can hit the ball shoulder high, waist high, below waist high. It makes sense to keep your options in the middle of all three and not restrict yourself. The photo in the middle takes this common sense ready position into account. The racket face is placed waist high, and you adjust one step up (high ball) or one step down (low ball).



The established ready position is on the far right, the racket face is held cocked up above the hand and in front of your face. From here you can adjust one step down to get the medium ball, yes, but two steps to get the lower ball. Since most balls are going to be struck lower than the racket face in this ready position, why start with it so dang high? Furthermore, it can be distracting with the racket at eye level. And if you're thinking you should start this way since the volley needs to be hit with the racket head cocked above your wrist to form a letter "V" or a 90 degree angle there's more coming to show you why that's foolishness.

Say "buh-bye!" to the letter "V," to a 90 degree angle, to getting down on the low volley, to stroking high to low, to locking your wrist, hitting out in front, extending, and turning the shoulders.

You're in the ready position. What's the first thing you do, prepare the stroke or move first? You move first. If you move first your instincts will start calculating your space and time and contact issues for you better than if you were standing still "taking the racket back," and no one stands

still at the baseline taking the racket back first. You do not prepare the stroke first, which means you do not turn the shoulders first. Gotta move.



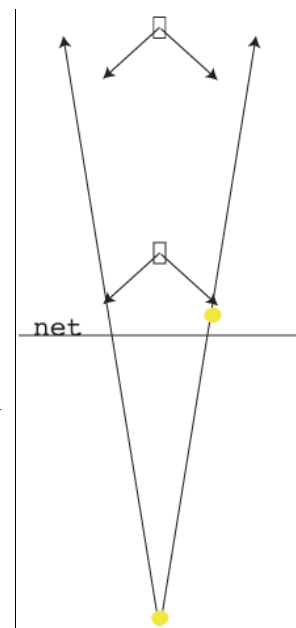
Luckily up at the net when you move you're not moving to cover distance as you do on groundstrokes. When you're up at the net:

### FACT MOST-IMPORTANT: BALL'S ALWAYS CLOSER

When you're up at the net the ball will never be as wide from you (left or right) as it could be when doing a groundstroke. This means you don't have to run down anything that's wide; you really have to respond to what's in front of you; you don't prepare the stroke out wide from your body at all 'cause it's not going to be like that.

Second thing on your mind is: You're going to take 2 steps. If you (pivot and) take one step to hit the ball you must be a Pirate with a wooden leg, Yo Ho! or your pro is.

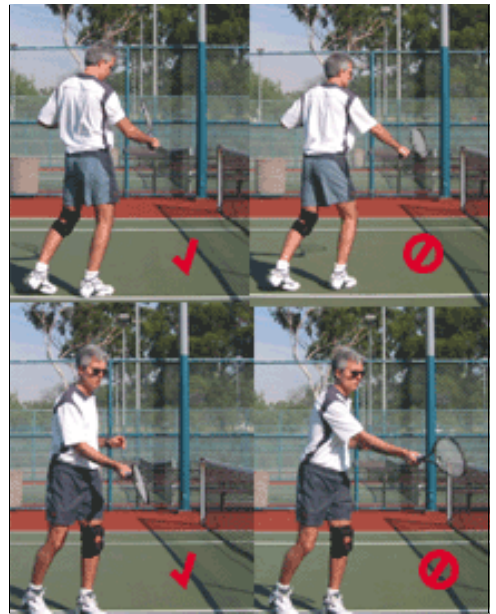
Movement starts your brain's process of figuring out where, when, and how you're going to hit the ball, you can't figure this out by standing still, unless you play golf, and golfers need a lot of help. 2 steps lets the brain calculate best.



- Get closer to the ball than you think.
- Stand up, don't get down.
- Relax the wrist when preparing the stroke.
- Lock the hand, not the wrist.
- Lower the racket head to the height of the ball, don't lower the hand.
- Always keep the arm closer-in to the body, both sides.
- Let the ball come in, don't extend out to the ball.



- Stroke pattern is low to high, or level, and not high to low.
- Don't turn your own head to look at the ball, just the eyes.
- Hit the ball ahead of you, but not out in front as it's referred to.
- Let the ball bounce up off the strings.
- Up at the net it's death by sweetness, you're not dropping The Big One on your opponent.
- You have enough time to react, and enough space within which to work.
- And last, use the wrist. Oh, please, this one's a joke.



The volley has three parts, psychology, technique, and art. The first two we butcher when talking about it. Art?

### **FACT MOST IMPORTANTE TOO: RACKET DISTORTION**

At contact the racket face opens and drops down, or wobbles, just like on groundstrokes, serves, everything else. The racket face distorts, it's called equal and opposite reaction of ball onto racket. All other strokes have a (backswing and a) forward swing that creates momentum to counter (but not overcome) this distortion but a volley does not have this counter momentum because it does not swing back or forward. A volley never has this counter momentum but sadly the tennis establishment teaches a high-to-low volley stroke to develop some counter momentum. That's like saying h-o-old onto the steering wheel with both hands driving the highway because your car's front end alignment is off. Align the wheels of your car, align the racket's forward stroke better into the ball (more upcoming).

Example:

Your tennis teacher wants to show how you don't have to swing at a volley to make the ball go over the net. You're standing up at the net simulating a volley contact spot with the racket out in front of you and the teacher throws a ball hard into your racket face and asks you not to swing. What happens? The ball bounces up off the racket and over the net on its own without the racket moving into the ball. Lost in this familiar example is how the racket face bounces back and down. Even if you gently drop the ball onto the racket face the same thing occurs - the racket face bounces back and down - though not as pronounced.

This distortion on the racket face is undeniable in all strokes but it is the key to understanding how-to hit a volley. Your priority is going to be to work with this reality and not think about "hitting" the ball as you do for all other strokes.



## FACT: TIME AND SPACE

I know you feel you have less time in which to react to a ball when you're up at the net and that you have less court space in which to hit your return, yet while this may literally be true this isn't reality. There is enough time and space for you to do your thing. Don't freak out ahead of time. It's like everything else, once you learn, or know how to do it, you realize it's not that hard to do.

## FACT: THE VOLLEY IS AN ORPHAN

A groundstroke is hit in response to an opponent's groundstroke, you take what's coming at you and send it back in the same way. A return is a response to a serve, an overhead to a lob. An approach shot is a response to a weak groundstroke, but a volley is not a response to another volley. A volley responds to a groundstroke, yes, but the volley reinterprets what came at it. It takes the groundstroke and changes it into something else: the beginning of the Volley As Art idea, that of reinterpretation. This helps explain why you have trouble exchanging volleys at the net in doubles, you're expecting, wanting, a groundstroke to hit against, and when it's a volley coming at you it's tough to hit a volley in return (you either whack it or fail to hit a good one).

## THE GRIP

Plenty of other sites explain the volley grip and I won't here. It's basically in between a forehand and backhand groundstroke grip, it's an open face on both sides to lift the ball, and you use one grip. If you're changing grips and you want to improve, graduate and use one grip. By the same token you can still play if you just have to change grips, but no complaints, please.

## MOVE FIRST, PUH-LEASE

If you "prepare" your stroke first by turning the shoulders and reaching out to the side you are telling your instincts you are prepared to hit the ball with this amount of lateral reach. Either you'll move just enough to r-e-ach for the ball, or you'll back away from the ball to keep that lateral reach you prepared for. Don't retrofit your body to satisfy your stroke, a common theme in **Revolutionary Tennis**, and remember the first volley fact is the ball won't be wide from you so don't expect to re-each out w-i-de for it.

## MOVEMENT REALITIES

Take 2 steps to hit the volley, not 1 step into the ball with the front foot, which is a lack of rhythm. **Revolutionary Tennis** offers how rhythm from body and feet feeds and leads into good stroke production, meaning the minimum number of steps for this is 2. And forward, not ever parallel to the net.



You move the back foot first, then finish with the front foot. Yes, there is enough time to do this, and you most likely are doing it unless you try to be a good student and take only one step with your front foot - which is why your volley is not-a-good. Tiny steps here at times.

You don't have to put that second step down before contact. You can step down with the second step after contact, just as long as the second step was on its way. This area is finally being acknowledged by the tennis establishment, that is step-hit-step, yet the larger picture that it is two steps that forms this reality is missing from their tennis brain - or do they want you to step into the ball with the front foot and then do the second step (step-hit-step) with the back foot? Doubt it.

## **STROKE PREPARATION ... MUSCLE MEMORY**

You're gonna move first, remember, but to develop the right kind of muscle memory for stroke preparation let's go back to the ready position.

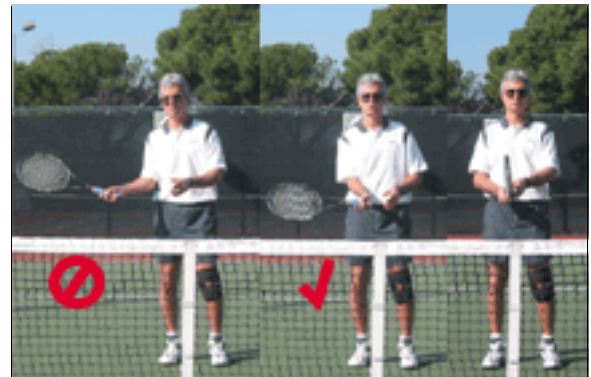
Due to the fact the ball's always closer to you laterally than at any other time, stroke preparation is small and minimal because the ball's going to be close to you. The stroke can expand easily if the ball's a little farther away, but not the other way around.

The closest volleys are the hardest to hit, right? And backhands have no strength? Time to end all this nonsense.

## **F/H PREPARATION**

A forehand volley is tennis' one unnatural stroke. It requires an open racket face, no wrist, and no pronation.

If you don't move the racket and arm out laterally to the side, or turn the shoulders, how do you prepare? Only the hand moves the racket face to the side, either up, waist high, or low, depending on the eventual contact spot. The arm does not, ought not, move to the side. You first prepare the stroke, you are not yet reaching out to hit the ball. This is how you make the smallest lateral move with the racket face so you can then reach out to the ball (remember the ball's always going to be closer to you laterally than on a groundstroke). It's a lot easier and simpler to expand the stroke as needed to reach the ball than to pull the arm in (or step back, or slow down, or stop moving) if you prepare with the racket extended out to your side. Don't overplay your hand from the get-go.



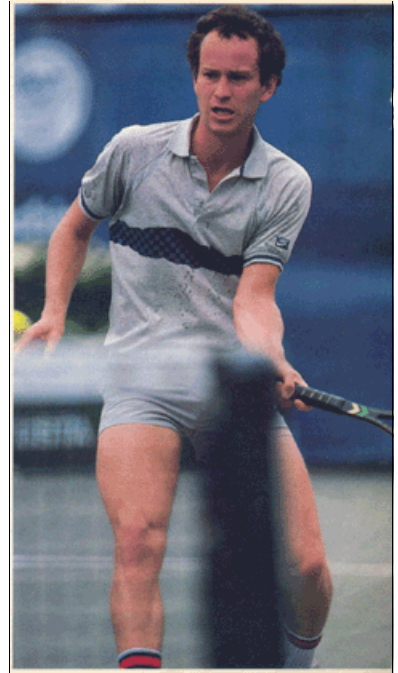
The photo sequence on the right illustrates how this works versus the establishment's way. The forearm does not move. If the forearm moves you are calculating for a wider shot.

The elbow tries to remain in front of the body as if it were holding a tennis ball against the front of your body/hip. This is awkward, but the idea that the elbow is in front of the body/hip for contact is the same for a forehand groundstroke. It's easier on a groundstroke because you get to swing,

it's harder on a volley to place the elbow and arm in this position from the get-go.

[Of course on a pro's slow motion replay you'll see his/her racket face go back, but we're all trying "not to do that" and instead are trying to achieve contact with the elbow out in front and the arm bent for flexibility and leverage.]

The photo of McEnroe illustrates this idea best. His elbow is close in to the body, and in front/ahead of his body (in the direction toward the net). More importantly his wrist does not form a 90 degree angle to the racket, it appears a touch droopy because the racket head is lower than the hand since the ball is struck below the waist. The idea the racket head can be lower than the head has recently been embraced by the establishment, specifically Dr. Jack Groppe, but he, along with others, still insist on some phantom uniformity regarding a 90 degree angle between wrist and racket for high, medium, and low shots.



If your arm does not achieve this scrunched look, or feel that way, you not only lose leverage but strength in your hand for the contact. You've just got to play it in tighter than you think which, not ironically, is just how it is on a f/h groundstroke. Your chest needs to turn slightly to face the contact spot. As stated earlier in **Revolutionary Tennis**, when you move you turn automatically. But on volleys, where you're taking 2 steps instead of 4, you need to remind yourself to "turn" a bit (same for returns, by the way). And here you're turning the chest, not so much the shoulders.



### THE WRIST LAYS BACK ON A F/H

Preparing the volley on a f/h means the wrist lays back. And to calm down dear old Vic Braden, just because the wrist lays back does NOT mean you're doing this "in order to snap the wrist into the ball." The sky isn't falling, Vic, with this maneuver. You will lay the wrist back and it remains relatively fixed. Although you know the wrist still moves on a volley to absorb and counter the impact...hee, hee...or else the racket face would really blow out backwards. But I promise not to talk about that.

The idea that the wrist remains locked and fixed like a brick wall is misleading. What locks and remains fixed and immovable like a brick wall is... your hand on the racket handle. Your fingers, your palm, on a backhand the back of the hand and fingers. You don't have a death grip on the handle, no, but your palm, and fingers, and hand need to resist the impact, the wrist works with the impact.

The wrist is the hand's source of strength, it supports the hand. The racket is not connected at the wrist. The hand can be strong during the impact only if the wrist flexes its muscle, and if it is



flexing it is not literally fixed or locked. The wrist acts as a shock absorber and not a brick wall.

## B/H PREPARATION

It's easier to prepare for a backhand, the forearm doesn't inhibit (moving to your side) when you prepare the racket over to your side.

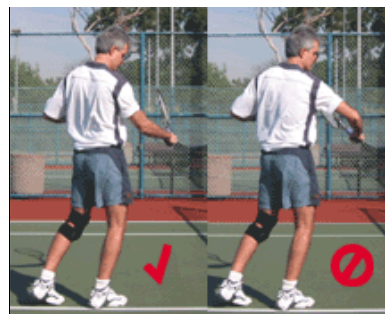
Carry the weight of the racket in the off hand, and let the off hand prepare the racket face waist high. Turn the chest to face the contact spot, slightly to your one side, and try to curl the front shoulder to first give your upper arm more strength (then forearm, wrist and hand). Assuming, of course, the shoulder remains motionless during the volley.

Remember that movement into the ball (and hitting on time) yields stroke strength, the arm's strength does not do this. If you "turn" one or both shoulders for the backhand volley you are not moving first.

Strengthen the wrist and allow it to remain flexible. The wrist is going to deflect on a b/h even more during the contact so allow it to. That is, work with it, don't try to make it absolutely locked 'cause that'll lock up your arm and then you're stiff, lose leverage, and it gets ugly. There is just no way your wrist, or mine, can be locked solid on a volley, a backhand in particular. A forehand has a better chance, though it won't be 100%.



On a backhand groundstroke the ball bounces and loses power before you hit it, you need to unfold the arm out away from you (side fence) and in front of you (the net) for max leverage to hit the ball for distance (photo far right). These parameters are not there for a volley: you hit the ball before it bounces, not for distance, and it's not as wide from you. Instead, the elbow here is held closer to the body to leverage the arm's strength in what is a smaller situation (photo left side), and for the same reasons the contact is not out in front of you as much as for a groundstroke.



Prevent the front elbow from lifting outward or pointing to the net before, during, or after hitting.

## “V” IS FOR VICTORY NOT VOLLEYS

The famous “V” shape or 90 degree angle that celebrity teachers point to is foolishness.

The “V” angle between the side of your hand (base of thumb) and the side of your forearm is not fixed due to the volley realities stated earlier of a leveraged arm and three contact heights. Furthermore, there's another, second, “V” angle formed between the wrist laying back (back of the hand) and the outer flat part of your forearm. Neither “V” remains fixed.

That a "V" exists is true, establishmentarians, but it's a flexible affair, not fixed, and there's two of them, not one.

Dr. Jack Groppe, a self described sport scientist who grew up playing little league and not tennis, writes in his "High Tech Tennis" book that the "V" is his more insightful recognition of volley success than an earlier "myth" of keeping the racket head cocked above your wrist when volleying. He writes, "The racket head can even be positioned below your wrist with the same wrist angle as when held above your wrist. Therefore, key your playing on the wrist angle and not necessarily on the racket head position." Sounds like another way of saying the same thing.

But is this true? Can "The racket head...be positioned below your wrist with the same wrist angle as when held above your wrist"? You be the judge.

The photos illustrate the "V" on the volley if the racket head is positioned below your wrist with the same wrist angle, "about 90 degrees" like Groppe opines, as when held above your wrist. I taped a ruler to my racket to maintain and illustrate just what, in Groppe's words, "maintaining a consistent angle between wrist and racket shaft whatever the level of the ball" really would look like on a variety of shots.



The first photo on the left is fine, both f/h and b/h versions, but the leverage realities of the arm deteriorate with each successive photo where I strive to maintain a consistent angle between racket shaft and wrist.

Is it any wonder players like Bryan Shelton, on the right here, have so much trouble with their game? He has no leverage on that contact spot with his hand so low, he needs to be standing up more and





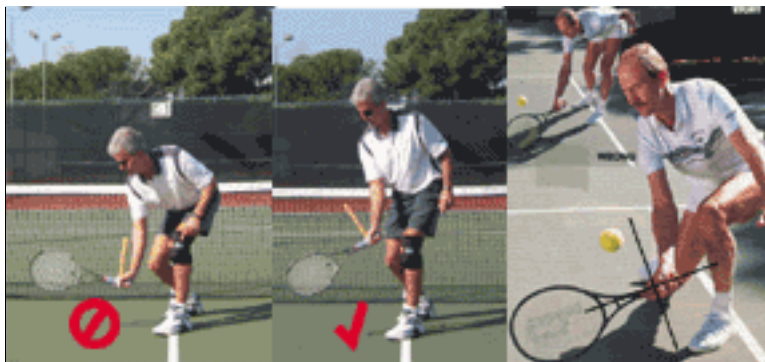
allowing the racket to reach down, as I show on the right, though I didn't set out to relate directly to Bryan. I should drop down farther, I'm merely standing, but the racket is working correctly. Bryan has no strength for his contact spot, a fact made obvious if I could gently push on his racket face. On the other hand, were he to stand up and lower the racket while I pushed gently on his racket face, he would feel stronger.



The genesis of our misunderstanding lies in the fact that on the comfortable and strong chest-high volley there is an angle of "about 90 degrees" formed between wrist and racket shaft. The problem follows when you take this observation from this one example and apply it to volleys hit lower than chest high. In so doing you are retrofitting form to satisfy an arbitrary requirement and you wind up ignoring concepts of leverage from arm to racket to contact spot.

Getting down as low as Pat Cash for a volley is impossible, and that's not why he won Wimbledon. The fact that it takes a man as strong as Pat to volley "correctly" per the establishmentarians should be a sign that maybe their understanding and concepts are a little medieval.

Stan Smith's low how-to photo clearly shows a wrist to racket shaft angle not close to being "about 90 degrees," and the greatest talent at the net, McEnroe, shows this as well.



Of course when you learn to volley in this new way, that is you allow your hand/wrist to relax down, let the racket head drop, the ball is going to pop up off the strings and go out, assuming your posture is good. You're going to have to get used to not stepping on the gas pedal while simultaneously braking, which is the old fashioned way of locking everything but extending and punching down hard on the ball. Once you get the hang of increasing your stroke's leverage by making better use of your arm's leverage technique you will be working less for your result: the ball comes up better and goes deeper, with less effort.

A shortstop keeps the webbing of the glove above his wrist to snag a ball chest high, tilts it to his side and below his wrist for lower balls. Shortstops don't get down and keep the webbing up on a low ball. Our racket face is our glove, not the racket handle.

I've included one of Groppe's earlier articles (at the end here) on this 90 degree foolishness of wrist to racket. First it was the "V," that is keep the racket head above the wrist on all volleys,

and now it's not that, no, it's, it's, it's... keep things at a 90 degree angle. It reminds me how medieval astronomers added sub-spheres to their main theory of how the universe revolved around a stationary earth to help reconcile inconsistencies they were unwilling to attribute to what was a flawed theory in the first place.

Groppel's a nice guy, from the midwest, but with a bachelor's degree in wildlife biology (and later Phys Ed and Biomechanics degrees) it's clear tennis was not, and is not, his talent.

This whole idea of a fixed relationship between wrist and racket is ludicrous, no wonder our juniors can't volley their way out of a paper bag, they attend tennis academies influenced by the likes of Groppel, et. al., who preach this dogma. All that's missing is a non-profit tennis academy and they'll be tax exempt. Just why are these alleged "tennis scientists" taking over tennis teaching? None of them plays better than a high school doubles player, none toured as a junior even. Just why have we allowed "tennis scientists" to hijack the game? Time to get off my soap box.

## THE WRIST

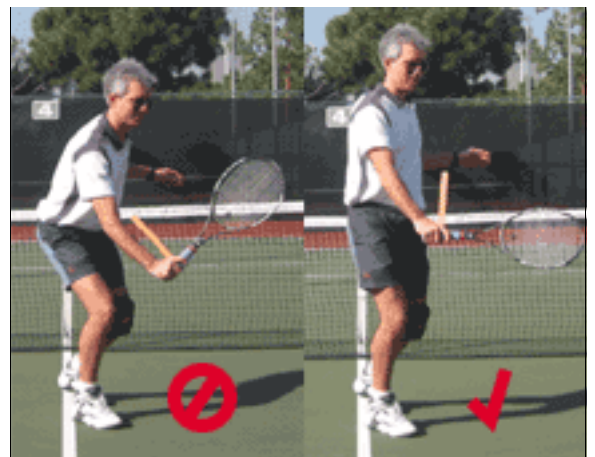
The wrist first relaxes to prepare the racket up, medium, or low while laying back. Then right away it stops relaxing and firms up to you load strength into your hand. The wrist acts like a shock absorber here and recoils and moves to provide strength to the hand so the hand (and not the wrist) can be firm like a brick wall. The wrist should not break in any traditional or non traditional way, it still remains in a cocked position after the f/h, unlike Groppel's disingenuous version upcoming. On a backhand the wrist shouldn't go backward or forward.

In both f/h and b/h you'll notice the wrist isn't supposed to move even after contact, but in reality you, consciously or subconsciously, will move it to counter the opposite effect of the ball hitting against the racket. You break it on the f/h, flick it on the b/h. Big no-no. Perhaps this is why establishmentarians try to teach the driving volley, this swing-like volley masks a breaking or flicking wrist. The solution lies in steeling yourself into keeping your hand firm - your hand firm - prior to contact, through contact, and after contact.

## STAND UP TO THE BALL

Posture is strength. If you are too far away from the ball (ball is to your side or ahead of you), and/or bend down to the ball you're going to lose your posture and thus your strength. So get up closer to the ball and stand up to it.

Stand well, balance well, keep your torso back. Trust, or learn, how your body supports your stroke and how vision and your body's sensing mechanisms, not conscious thought, are responsible for timing. The stroke does not do it all, not even half of it. Your body does, your body as a whole kinesthetically provides the data your brain needs to calculate the execution sets it sends back to your body to interpret and act upon.



## HERE COMES DA FUZZ

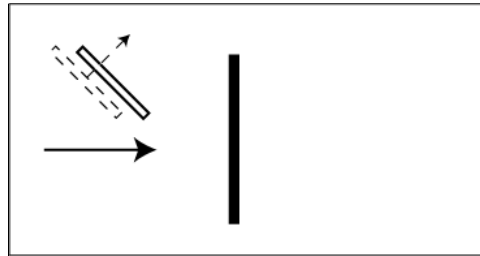
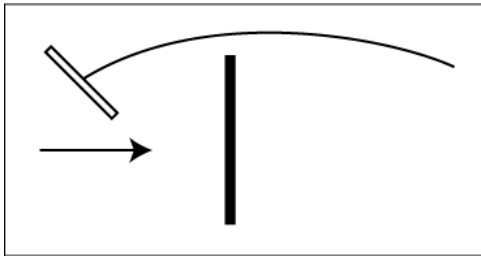
Don't move your head laterally to track the ball, just let the eyes track any lateral movement. This keeps your head still, your torso back, and helps you time the ball. Why? Again, the first fact about being up at the net: the ball's not going to be very wide from you.

Up at the net players too often turn their head to the side right away and immediately they're telling their brain they're going to hit the ball later than they ought to, or they're too aggressive and bend over, similarly giving their brain the wrong contact coordinates. Since volleys require greater timing you need less gross body movement of all types.

## COUNTER RACKET DISTORTION

The ball's going to distort your racket face, remember. Expect this distortion and work with it, work through it. Firm up your hand, strengthen the wrist, and allow for some wrist flexibility during the hit. Continue working through the hit to keep the racket up/prevent the racket from going down. Only control freaks expect their wrist to be as solid as a brick wall during contact, so if you're not one let go of this idea.

## THE CONTACT SPOT - LEVEL, OR LOW TO HIGH



You take the contact spot as you can get it, high, medium, low, in tight, out wide, fast, slow, early, later, off center, off balance, confusing, whatever. You can't expect to always have the racket at just the same height with regard to the hand and out in front just the same way to hit with just the same spin all the time. You can't be anal up at the net.

Just like on groundstrokes, the racket head's going to be at a different height relative to the hand on each shot: at times even with the hand, at times below the hand, at times above the hand. Imagine, if you will, a low groundstroke where you get both your hand and racket face all the way down to the ball, or a high ball where you keep the wrist and racket at a particular angle to each other. Ridiculous, but this is how the volley is taught, as well as half-volleys.

Hit level to lift the ball, or a very gentle low to high. What's the problem with that? You're up at the net, place an open racket face below the ball and allow it to bounce UP off the strings. Prevent the racket face from dipping down on contact, lift the ball above its contact spot. Every stroke lifts the ball above its contact spot, volleys are no different.

A high-to-low motion imparts a lot of back spin on the ball and can lift the ball up and high over the water hazard - this is tennis! A lot of back spin executed on a wooden or grass tennis court, where tennis began, makes the ball squirt on the bounce. But on today's surfaces that ball sits up, it doesn't move forward much on the bounce. Certainly professional athletes can at times cut at

the ball on their volley and the ball stays down, but just how many players have good volleys nowadays?

Gently low to high, or at least hit level through the ball.

## STROKE PATH

As with groundstrokes the contact path line is outside in, the arm compresses and gets closer to the body (unless you choose to hit inside out). I know you're told to go out and extend the racket away from you either in front toward the net or out to the side with the arm, but, then again, your volley's not-a-good, right?

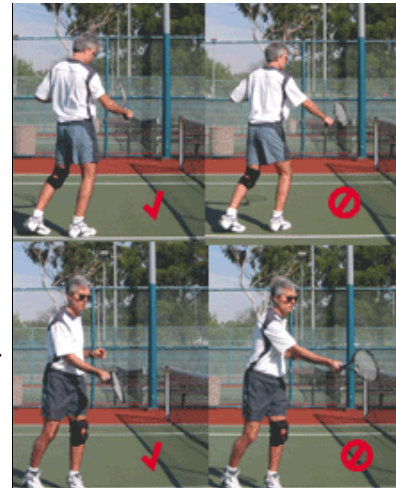
## OUT IN FRONT

Out in front is a teaching device for those who hit late. You're supposed to hit "out in front" so you don't let the ball get by you, but players take this meaning too literally and extend, or straighten, their arm to hit o-u-t in front. The arm is a leveraging device and needs to be bent, or flexing, during contact and not straight.

The arm is a leveraging device, it acts as a spring, if you will. If you straighten your arm to then hit the ball you will have literally sprung your spring and the volley is impotent. It's common to find the magazine or web site pro advocating straightening the arm on a backhand volley. Yeech. Similar to a groundstroke, the arm is bent and unbends for contact, though in minimalist manner.

The left photo of Jack Groppel on the right shows the

arm too straight and hitting too far out in front and away from his body laterally for a successful volley.



Groppel is answering a question here in the USPTA magazine on whether a volley's racket head rotates before impact. He says "No racquet head rotation occurs [on high-speed film] immediately prior to or during impact. However, after the ball is struck, the racquet head often is seen to rotate toward a more slanted position [i.e., open]." He certainly doesn't show that with his straight arm and wrist flex in the second photo. This is a prime example of how the self-described cognoscenti will information on the tree of knowledge but can't put it all together because they haven't been told/been able to read how or lack real experience. He glosses over



one of the two major facts uncovered here by **Revolutionary Tennis** that help explain how to volley, namely racket face distortion on impact. The racket face opens and goes backwards, as mentioned above in Fact Most Important Too: Racket Distortion. Understanding this inevitability and working with it instead of against it would give Groppe a far different and better looking finish on his volley, and a more effective result: racket held at an angle and not perpendicular to the net, arm not straightening.

## VOLLEY PSYCHOLOGY

You have to subjugate your ego when you're up at the net. You have to be willing to win the point with the scalpel instead of the ax.

There is no such thing as a put-away volley, only the opportunity to win the point. And if the opportunity isn't there, then you control the point and take the opportunity away from your opponent so you can hit a second volley.

There is no such thing as a driving volley, only the rare opportunity to hit one solidly because it's above the net - there's no swing to a volley.

Win without the big bang, don't be afraid to be up at the net, invite the opponent to hit at you. When up at the net you can't be afraid of losing the point, or of looking bad, or of being passed, or of being hit with the tennis ball. It's normal. If you're up at the net you want the ball to be hit at you because you'll have a better chance to reach it. Think about it. Bring it on!



The above photos come from TENNIS magazine's "Complete guide to the basics of the game" supplement, photos by Caryn Levy. Each photo, you can now see, is seriously flawed. The interior photos represent the first movement up at the net. Not so bad that she's moving, but she's moving parallel to the net, she's turned her body away from the ball - considering she will try to step forward. She opens up the stroke far too wide from her body, moves across markedly on the f/h while extending out to the side with the stroke, and on the b/h while not stepping wide as on the f/h she's straightening her arm down while also extending out to the side. Her arm has no leverage on either side. For both contact spots her head is turned way too much. The magazine wanted to charge you \$1.00 each for additional copies. No wonder your volley is not-a-good and tennis hungers for players.

## VOLLEY AS ART - SWEET THING

The missing ingredient in "how to" hit a volley lies in understanding that the volley is art. The stroke is a reinterpretation of a groundstroke. Punching is too violent and active a term to describe the volley's execution. You are holding a mirror to the ball and reflecting it. Placement



works per earlier **Steps**, that is if you are on time you go crosscourt, if later down the line, for the most part. If the ball sits up, is not struck hard, and you are up close to the net, you can put it just about where you'd like to.

John McEnroe expresses this point the best, and Rod Laver is a close second. Pancho Gonzalez was a strong stud with style, Jack Kramer was strong but dull, Don Budge had a flowing grace. Gregg Rudzeski has one gear, Tim Henman has his heart in the right place but something's missing. I suspect Bill Tilden had a wonderful volley even though he "got down" like he didn't have to. The volley reflects the player's personality. McEnroe's been called the artist, and Laver had talent, plus a wonderful forearm and wrist.

While both Pat Cash and Stefan Edberg used established technique of getting down low to the ball with the racket face cocked above the hand and volleyed well, it is clear from their styles who is the more sensitive bloke. Clearly Edberg appeared more elegant and expressive whereas Pat was more workmanlike. Edberg always maintained great posture. Compare Margaret Court with either Martina Navratilova or Steffi Graf.



Taylor Dent here, in black and white, is trying to do his best per what he's been taught. The hand is down, the racket head up, or you can say the wrist is at about 90 degrees to the racket shaft, and the arm needs to straighten for these requirements. Since the ball is slightly above his navel it's clear this isn't the strongest configuration for the hand/arm that holds a 27 inch extension known as a tennis racket. Taylor's a strong guy and he makes this work, though he'd be the first to tell you he's not terribly consistent with that b/h volley.



The color photo in the middle is a reasonable copy of Dent's shot. The ruler taped to the racket handle indicates I'm maintaining 90 degrees. The white net tape behind the racket matches well with the photo on the far right to show virtually the same contact height. On the far right I am not getting down as much but instead opt to stand up for better posture, thus better strength into my arm and hand. My wrist is not in a cocked position and the racket face indeed becomes an extension of my hand (and its strength). You may have seen photos of McEnroe's b/h volley with his arm bent like this. There is a better way.

You don't need to have the personality of an artist to volley well. But you need to be humble and calm when you're up at the net, you need to be willing to fall flat on your face with your effort and still feel cool about yourself. And you simply can not try to impress anyone up there. No Charlie the Tuna's here, please.

I use a lot of the older players as examples because today's players simply don't know what to do at the net. And is it a coincidence, then, that tennis critics say today's players lack personality?

Vincent Van Gogh looked at the landscape and reflected it in his own design, he had something

very special inside him. You're not going to be a great artist like Van Gogh, or be as original. It's not necessary, this is tennis after all.

Remember taking art class and how difficult it was trying to draw, or paint? And the teacher asked you to slow down, to take your time, and to try to get it from the inside? Same for volleys. You simply aren't going to have the kind of volley you want if you stick your arm out there, if you muscle the ball, if you try to hit it hard, or if you try to impose yourself onto it. It's safe to say CEO's and ex-Presidents who play tennis have lousy volleys.

The volley is in its own little world. It's not baseball like at the baseline, it's not "quien es mas macho" like for a return of serve. The volley is art, and it's sad that by using these new rackets we are literally taking the art out of the game. If a pro's tennis racket were no more than 95 square inches and its composition limited, pros would be forced to come up to the net to finish points and the art of the volley would reappear - establishmentarians notwithstanding. And spectators would all benefit.

The volley is tennis' Sweet Thing. Mmm.

Photo credits when saved: Cash f/h, Stephen Szurlej/Tennis Magazine, 10/87; Cash b/h, Allsport/Roger Gould, Tennis Magazine, 10/87. Stan Smith, Tennis, 7/89. Edberg, Michael Baz, Tennis Week, 3/23/95. McEnroe, World Tennis magazine. Taylor Dent, Reuters, Los Angeles Times, 1/19/04.

## OLD THINK

- ready position: rax up
- first turn shoulders
- lock wrist
- arm to the side
- out in front
- maintain wrist to rax angle
- 1 step
- step across
- high to low
- get down
- reach down
- move your head

## NEW THINK

- ready position: rax level
- first you move
- flex wrist
- hand prepares rax
- closer in to you
- adjust wrist to rax angle
- 2 steps
- step into ball, forward
- level, or low to high
- stand up
- drop rax head
- keep your head still

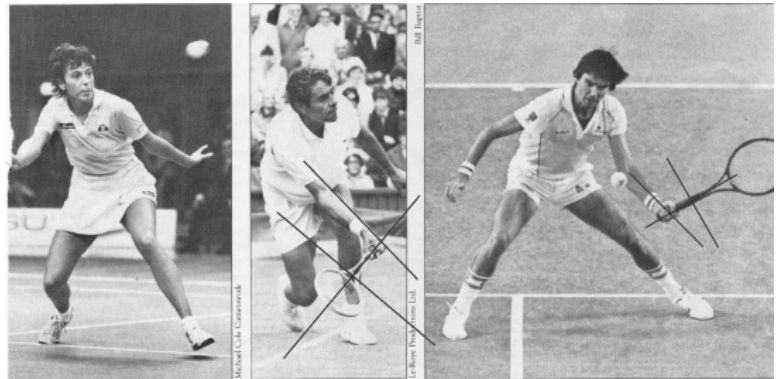
## Keep the Racket Head Above Your wrist

**This time-honored bromide is drummed into all aspiring volleyers, but does it apply in all cases?**

We learn much from watching the professionals play, but we also receive a lot of misinformation simply because we watch on a selective basis. We see one method in one particular situation and think it applies universally. The high volley is one such situation.

When the top pros connect on a chest-high volley, the racket head is held high above the wrist. Not only is this racket positioning important for providing optimum force and control, but I challenge anyone to hit the high volley any other way. However, working to keep the racket head above the wrist on all volleys is not the heart of the matter. What is key is maintaining a consistent angle between wrist and racket shaft whatever the level of the ball.

Consider the low volley which forces you to volley at about ankle height. In the picture above, the legendary Pancho Gonzalez is hitting a low volley in the 1969 Wimbledon Championships. Notice the angle (about 90 degrees) formed by his wrist and the racket. Then look at



the pictures of Britain's Jo Dure and Jimmy Connors. Both are hitting above-the-waist volleys and are maintaining the same racket-to-wrist angle as Gonzalez. It is this relationship that is important, not the height of the racket head. So don't worry about keeping the racket head up on low balls. Concentrate instead on keeping the wrist firm and the racket and wrist in the same relative position as they are on high volleys.

# Revolutionary Tennis

Tennis That Makes Sense

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## Step 11

### Serve Return & Approach Shot

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mark@revolutionarytennis.com

#### **SERVE RETURN**

Señoras y señores, bienvenidos a la corrida de toros. ¡Toro, toro!

Ladies and gentlemen, welcome to the bullfight, a.k.a. the return of serve. The bull charges, the matador stands his ground and plays it close. Similarly, your opponent charges with his serve and you, the returner, must in the end stand your ground and play it close.

**¡OLÉ!**

The serve/return dance is very much like a bull fight. The server (bull) has the advantage, but the returner (matador) can blunt the advance through skill. And, at the root of it all lies this question:

#### **¿QUIEN ES MAS MACHO?**

Jimmy Connors and Andre Agassi are the two most macho returners of all time. All the great Aussies were tough, too, Laver, Newcombe, Hoad, and Gonzales, Segura, and I'm sure Vines and Tilden were tough, but the idea of being mas macho, of actually taking that return and doing something with it instead of merely blunting the attack, is clearly exemplified by Connors and Agassi.

This is the psychology of the serve return, it's you against him/her. Who's going to win, quien es mas macho? Here comes the serve... ¡Olé!

Most everything written on the serve return is accurate. You're supposed to watch the ball as your opponent tosses it, move into the ball, look at it bounce, shorten your back/forward swing, put the ball back in play, chip or slice it, choose ahead of time where to place it, do what you can to get it back, don't play it too large, etc. All is valid.

Revolutionary Tennis will now add something distinctive to the serve return: vision and movement direction, that is how to watch the ball and in what direction to move to make sure you're moving into the ball.

If you follow **Revolutionary Tennis** you're familiar with the fact that the ball angles away from you, that to move "into the ball" your movement direction is on a certain angle relative to the

ball's angle, and that your movement pattern is based on having 2 feet. On the serve return it is all too common not to move into the ball but away with it. Inefficient footwork and movement direction compromises your vision (you're turning too much) and you miss time the ball, and it also compromises your body because it leaves your body in a position that can not support your contact "out in front." The result is crap.

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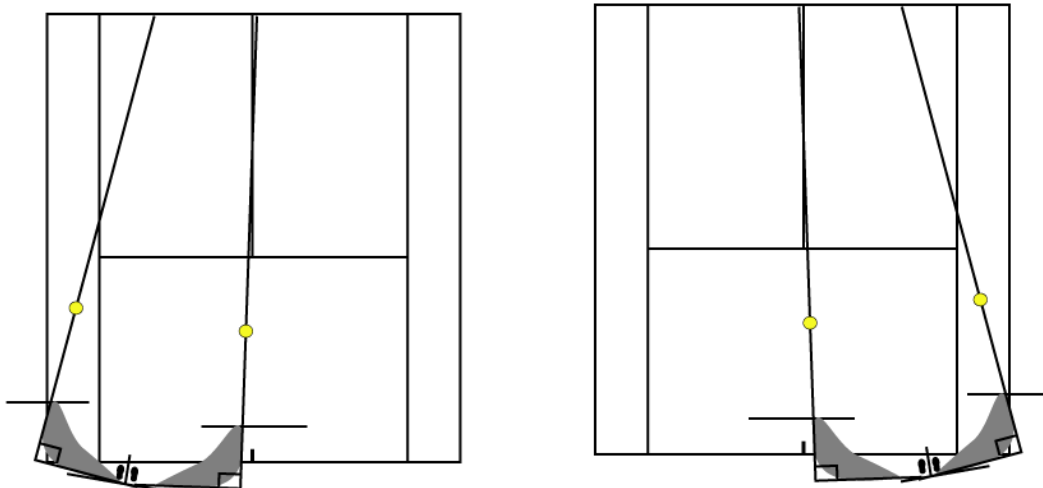
### MOVE INTO THE BALL - HOW?

No matter how well you play, for my money your return of serve improves when you know how to move forward into the ball. This is all about diagraming that understanding.

Moving forward means moving inside, or forward from, that 90 degree line you make to the ball's flight line. The following two diagrams illustrate where that lies.

To make sure you're moving into the ball you move:

- roughly to the net post, or down the alley, when the ball is on the alley side of the box.
- roughly parallel to the baseline and towards the baseline when the ball is on the T.



The grey area roughly indicates moving forward into the ball, and the horizontal lines at their ends shows how on one side you're always moving farther in the court than on the other. If the ball is slow you would angle forward into it a little bit more, and if the ball's not as wide you have to force yourself to move and forward, just like you have to at the net (because the ball's not wide away from you - see how it all integrates?). When the serve's in the T and you angle in forward too much, into the diagram's white area, you're moving inward too much and not to the ball.

These angles are different from a groundstroke so you have to get used to them, especially where on one side you move parallel to the baseline (serve in the T) and not into the body of the court per se like you "think" you ought to, and on the other side you're moving sharply into the court on an angle (serve wide).



## VISION

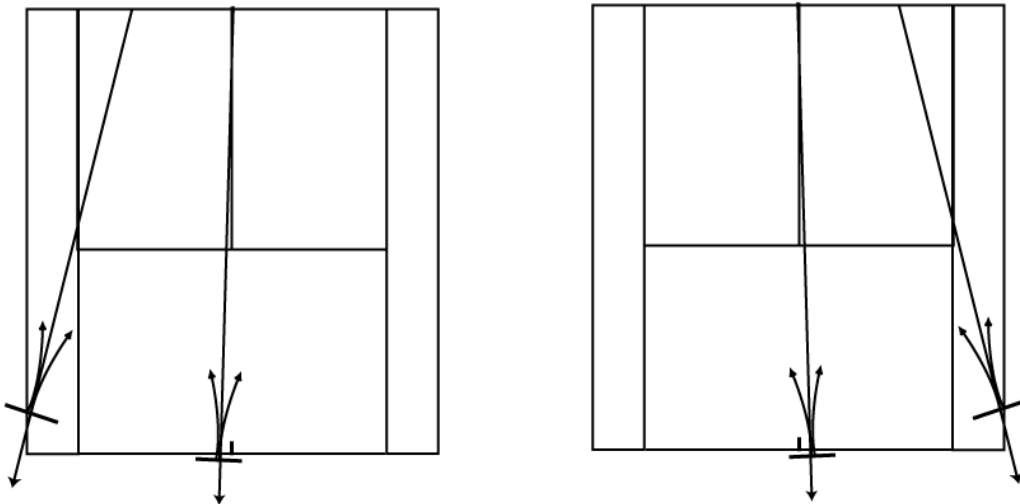
Vision requirements are the same but your perspective of and on the court is different for a serve return. Don't turn head too much on wide shots, don't turn head too little on T-shots or you'll naturally miss time them. See Step 7.

If you hit the ball long odds are you're turning your head too much to the one side and telling your brain you're planning to hit it later than it should be hit. Conversely, if it goes into the net or sharply crosscourt you're hitting too early and you're probably not tracking the ball laterally enough.

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## RACKET CONTACT

Perspective problems here too. You're used to the racket being more or less parallel to the net during regular groundstrokes executed more from the center of the court. But on serve returns your perspective and reality are both different.



Remember to look at this from a bird's eye view. It doesn't matter if you hit topspin or slice, I'm talking about the racket's point of view on the court.

When the serve is wide toward the alley, the racket, generally, angles into the court more than you're used to on most groundstrokes. When the serve is in the "T" the angle is more parallel to the horizontal lines and net than you're used to (unless you think on groundstrokes your racket is supposed to be parallel to the net at contact, if so see Step 6).

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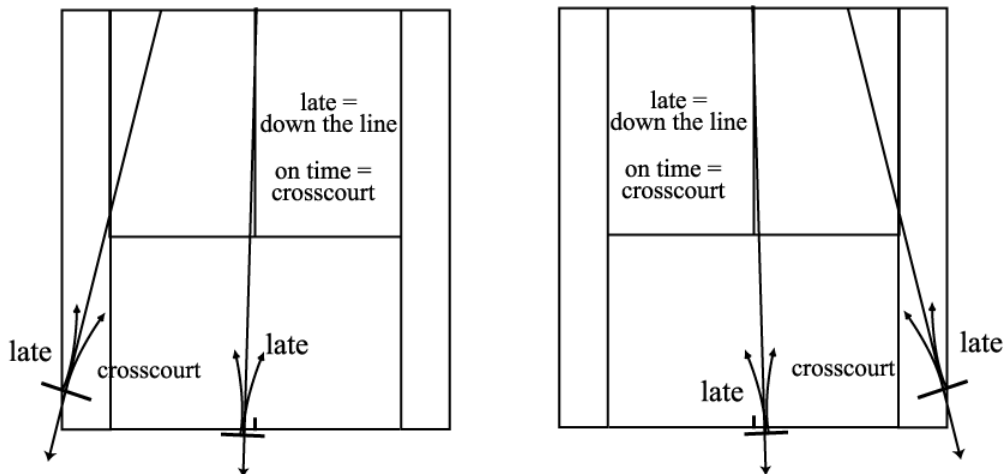
## PLACEMENT

Placement is simplified into hit left/right, deep/short, wide/center. Divide opponent's court into 2 halves, left and right side, that is his forehand and backhand. Divide that into 2 more halves deep and short, using the service line as demarcation. Divide that into 2 more halves, wide, and center.

Determine ahead of time where you want to return the serve, at least to one side or the other. Of

course if the serve doesn't cooperate and you have to change your mind you change your mind. Just don't wait until the last possible moment before deciding where to hit it. Get that part out of the way as soon as possible. The beginning of Anticipation (a good subject for another individual section).

When you're on time you generally go crosscourt easier, and when you're a little later on the ball it goes down the line better. These are directions from the racket's point of view, remember, per Step 7.



A lot has been written on how to play against certain types of players. Regardless of who you play against and the strategy you use against him or her you'll need to move efficiently, move in the proper direction to go into the ball, move your feet in a particular pattern for rhythm and balance, and see the ball in a particular way for more success.

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## APPROACH SHOT

It used to be the approach shot was all about running up to the ball, stopping, turning sideways, being flat footed or standing "balanced," stroking, then re-starting yourself and going up to the net. In other words, run, stop, run again. Thankfully that bit of business is over with.

Today, for the most part, players are told to move (not run) through the ball as best as possible, that is you should not stop before you hit because this is a fluid stroke, like a running forehand or backhand. You can slow down, yes, but not literally come to a stop.

I wrote those two paragraphs and decided to search "approach shots" on the internet. I found:

"Hit the ball from a motionless, balanced position. At impact, both feet should be firmly on the ground in a balanced position with your body weight equally distributed."

"Turn sideways completely when preparing to hit your approach shot."

Gag me. The Flat Earth Society exists, too. Look 'em up.

Your body weight will not be equally distributed, it can not be since you're moving so much

through the ball; both feet will not be firmly on the ground for the same reason, though one of them will be; and sideways, or turning sideways, does not belong in tennis' vocabulary for any stroke.

## DIFFICULTY - SOLUTION

The difficulty on the approach shot, if you just look at the stroke itself, lies in the fact you are moving through the ball when hitting it. You're moving through 'cause you're on your way to the net. With so much movement your balance, vision, and timing are easily thrown off. It's a cousin of the running groundstroke, yet you don't get a full runner's gait, a full swing, and a full court to play into that a running groundstroke enjoys, all of which help mitigate problems associated with movement.

To prevent problems associated with movement keep your torso back, don't lean forward. You're going to lean forward when you first begin to run forward, yes, for 2 steps, but then catch yourself, bring your torso back, and let your legs take you to the ball. You are not running a race where your chest has to lean across a finish line.

Most of the advice on how to stroke an approach shot you already know. That is you generally hit the ball up the line, the stroke is shorter than a full groundstroke, you don't go for too much, you strike the ball at the apex of the bounce when possible. **Revolutionary Tennis** does not have much to offer in this area except to that the open stance forehand approach shot, often taught today as running up to the ball, stopping and loading on the back foot, must be a conspiracy to make the approach shot, and the ensuing volley, extinct.

## FOOTWORK - BALANCE

Your gait is important when running up to the ball, it leads directly to your balance and posture when striking the ball. You should strive to take regular style steps, where one foot passes the other, for as many steps as possible. Obviously when you're closer to the ball you'll need to take small steps, that is small steps or stutter steps, and not side-steps. Pros stutter step and the ensuing effect is sneaker noise, but sadly the teaching establishment understands this as taking side-steps.

You will slow down as you get closer to the ball. Your gait will adjust and the steps may stutter, but at least for the first 2-3 steps you should try to move as normally as possible. It's not important for you to speed up to the ball, it's important that the rising stakes don't detract from your personal control. Too often everyone just plain ole rushes everything and the result is crap. Be poker faced.

Think here for a second. You're running, taking regular length steps, and suddenly you take smaller length steps. What happens to your torso? It leans forward. Prevent it from happening, don't act like a cartoon character who can't stop leaning over and falls off the cliff.

The big misdirection in established technique for the approach shot is arguing which foot is down last prior to contact. Back foot for open stance, or front foot for closed stance?

It doesn't matter which foot is down last prior to hitting the ball because you take the timing as it comes. In this manner you focus on what's important for an approach shot: getting up to the ball

appropriately, not rushing or overdoing, remaining in control. Perhaps this helps to explain the success of both styles, front/back foot, on approach shots.

Of course you can argue hitting off the back/front foot is better for up the line/crosscourt, but you should figure this out by yourself. The only time when hitting off the back foot is really needed is on a running groundstroke.

In fact, celebrity teachers are trying to "teach" players to keep their center of gravity ahead of the front foot on contact in order to get to the net faster. That idea, though valid, is related to movement and balance. Improve on those two areas per **Revolutionary Tennis**' ideas and the center-of-gravity thing becomes moot.

## **SIDESTEPPING - WEAKNESSES - SOLUTIONS**

At times you may need to sidestep into the ball, that is you do a series of 2/4/6 sidesteps sideways while moving forward. Not recommended but often it happens because it happens. That's okay, as long as you realize what you're doing and understand its weakness. It happens when the ball's slow and you're all over it like a fly on garbage.

The weakness of sidestepping into the ball is threefold. You don't cover ground as best as possible (though it may not be necessary), it throws your balance off way more (you're leaning to the side), and your vision will be further compromised by leaning to the side.

You can sidestep into the ball as long as you don't try to cover ground with this stepping pattern. Sidestepping into the ball is for taking up time, as in the ball's slow coming your way and if you moved into it like you really could you'd overwhelm it. Keep your torso back when sidestepping for balance and vision (not easy to do when you're imbalanced this way).

If you maintain your posture and vision requirements, and if you avoid rushing or overwhelming the ball, your timing can be okay even with the, ahem, aforementioned faux pas.

A popular footwork misconception promoted by the USTA and others involves the backhand approach shot. Here the misconception is the back foot slides in behind the front foot.

Moving the back foot behind the front foot brings you back away from the ball, the ball is angling away from you. It is needed only when you overrun the ball. It's simple geometry. By taking the back foot and moving it inward, or away from the ball angling away from you, you are then moving away, or inward, from it. Use this pattern to slow yourself down or if you've overrun the ball. However use a regular footwork pattern and a backhand approach shot if you want to get to the ball sooner and have more power available when hitting it.

## **VISION**

Keeping the torso back enables you to time the ball better. When you lean forward your eyes are telling your brain you're ready to hit the ball farther out ahead of you than is required. You'll feel awkward and the shot will be poorly played because you miss-timed the ball.

## **WHACK THE BALL**

One area that's not addressed is whacking the ball. Yes, you need to take a smaller swing, and yes, the stroke is designed to position the ball, but you still have to take a swipe at it. You need a full swing, not a full swing like a groundstroke swing, but a full "approach shot" swing, which means you swing but you don't drive the ball as far.

There is no traditional follow-through on an approach shot, it varies widely. Of course there is a "follow through" on the swing itself, but no set marker where to end up. At times you will punch-stroke the ball, other times you will bring the racket up, other times over one shoulder or the other.

Hitting the ball with more spin comes to mind here, but you can succeed brilliantly if you approach the ball, calm down, see the ball well, "hold" the stroke, and then strike the ball relatively flat. This works well, but I know it's difficult to do when the adrenalin's flowing and you're closer to your opponent and you want to drive it right by him/her.

Regardless of how hard you hit the ball, you still need the gumption to do what needs to be done. Too many people chicken out with their approach shot and play safe. Whether you hit the ball hard or deftly place the ball, you gotta have courage, man. Too many players walk the plank when hitting an approach shot.

Short approach shots work well, and hitting the ball through the singles sideline is often overlooked in favor of hitting the ball "deep" or into the corner.

Luckily you can practice this shot on your own. Stand behind the baseline and pitch the tennis ball up in the air and forward into the court. The idea is you're going to run up to the ball and hit it hard over the net and in the court. Start by letting the ball bounce twice before hitting it, then let it bounce once when you get the hang of it. You'll soon notice how your footwork and balance get thrown off simply by running forward, you'll notice how you'll miss-time the ball (vision) for the same reason. Follow some of the suggestions above regarding footwork, balance, and keeping the torso back and your result should improve.

## OLD THINK

### RETURNS

- pivot
- turn sideways
- use efficient footwork
- full stroke
- look at the ball

## OLD THINK

### APPROACH

- sidestep
- turn sideways

## NEW THINK

### RETURNS

- move, 2 steps or 4
- the DIRECTION of your movement
- look at the ball but be aware of your head turning too much or not enough
- makes eyes track the ball more than head movement
- stroke: a different perspective on the court than groundies

## NEW THINK

### APPROACH

- move normally
- moving is turning already



- front foot or back foot?
- back foot behind the front of b/h
- center of gravity
- doesn't matter which foot
- whack it

# Revolutionary Tennis

## Tennis Instruction That Makes Sense

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### Step 12

### The Serve

..... in many parts

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### **HOW TO IMPROVE YOUR TENNIS SERVE UNDERSTANDING THE FOREHAND HIT ABOVE YOUR HEAD**

I have been putting off the serve because I have serious doubts merely reading how to improve will benefit you. Here athleticism and practice are paramount to improvement. I can both lead you to the water and make you drink, but I have found that isn't enough. Be that as it may, I will try my simple best to lay out a path and an understanding to this unique stroke.

How did I get my serve? I don't remember. My first influential teacher I remember, Mr. Ferrari, had athletic grace and could style, and certainly my later "finishing coach," Mr. Francois Savy, was a great player with great body sense. My own father is athletic and very coordinated but he was a musician in his heart of hearts. I did watch Rod Laver play quite a bit and up very close as a kid, as well as all the guys on the tennis tour back then, and I have to say they served more gracefully than the talent we have today. Is that why we love Federer so much, and before him Sampras?

I remember a tossing drill, a racket acceleration drill, a wrist snap drill, and a muscle memory drill for flexibility and fluidity which I'll share with you, but I don't remember any gracefulness drills. Maybe that occurs from practicing, lessons, supervision. But I continue to surprise myself when teaching someone how to serve, there is still so much to know and see. Here goes.

### **IT'S ALL ABOUT YOU**

The serve is tennis' most difficult stroke because it requires a symphony of body coordination and you are on the spot. Ever deliver a talk to a group of people? Ever been the one at work or at home everyone's waiting on? You know the feeling, you get self-conscious. It's the same on a serve, we're all waiting for you to serve - come on! We're all watching that silly wind up thing you do - tsk, tsk, ho, ho. And then we rate you on the result - we all can do better. Humiliating, it can be.

Actors have to GIVE when under the spotlight; public speakers have to RELAX with an audience; politicians learn to SMILE for votes, and of course lie.

Tennis players have to OPEN UP to improve their serve. They have to open themselves physically, psychologically, emotionally. This, for me, is the precursor to improvement: Open up. To do this you need to stand well, engage the arms fully, toss higher to make more time in order to take more time, get the body to flex, swing with gusto, reach for more. *Dare to miss.* You

need *Cojones*.

On all the other strokes you do need to improve equally the areas of footwork, rhythm, balance, vision, and arm flexibility, but it's not so demanding for the serve. To improve the serve there is a **rhythm and order of events** to follow first, and then you must have:

- **your body turned a bit to the side**
- **your body weight going forward during the toss**
- **simple arm actions**
- **time between the toss and the hit**
- **a flexible racket arm**
- **zero self-consciousness**

The rest is wholly unnecessary. Unless you want more.

# Revolutionary Tennis

## Tennis Instruction That Makes Sense

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### Step 12

### The Serve

#### Part 1: The Service Stance

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#### THE SIMPLE SERVICE STANCE

Let's start with a Simple Service Stance and not one that is conflicted. A Simple Stance means **both** upper and lower body face in the **same** direction, off to the side, and **both** feet are close to the **same** angle to the baseline and close to parallel to each other. This is the stance I'm using at right. Your racket **points off to the side** as well because you are standing that way.

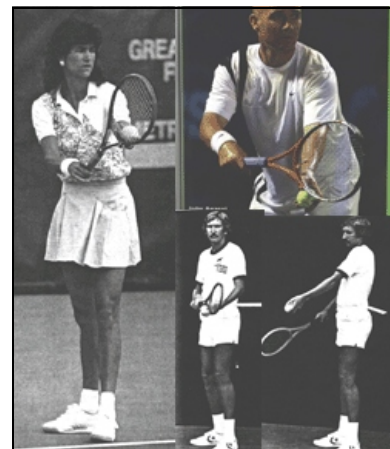
The Establishment orders a service stance In-Conflict. You start turned to the side but the conflict occurs when you point your racket at the service box because now your upper body faces the service box but your lower body faces off to the side. You're twisted. Adding to the conflict the front foot is at an angle to the baseline but the back foot is parallel to it, leaving you splay footed. Quack-quack. Why the stance In-Conflict? Because you are told to point your racket at your opponent. But do you have to? No. Is there an advantage with it? No. Why do it then, because it's historical? Beats me.



Andre Agassi on the far right starts this way, it's all too common. The girl on the left is a USPTA member, the guy on the lower right illustrates Vic Braden's ideas in his book. Not to be outdone, I also include Ivanisevic, Rusedski, and Rios all serving from the deuce court and clearly facing and pointing the racket to the deuce court instead of off to the side per



their stance.



[pros above USTA high performance newsletter, Vol.4, No. 1/2002; agassi on the right TENNIS magazine, 7/2004, part of an advertising section; USPTA girl from their Advantage magazine, date not saved; Vic's model from Vic Braden's Tennis for the Future, 1977.]

If you start with your body twisted with the stance In-Conflict there are two ways to serve. You keep your upper body still and turn your lower body forward to face the service box to match your upper body and begin your serve motion from there, or you can re-turn your upper body to the side to match your lower body turned to the side and then start your motion. The latter is what you do. And it is precisely here at this early point in the serve that your wheels fall off the track, before you've really started anything.

Why not avoid having to readjust or reconcile or compensate for being twisted in the first place? Why not start with your **entire** body in a normal, natural position since you are turned to the side? Why point your racket to the service box when this is the gesture that leads to the conflict? Why not point the racket off to the side and avoid this whole mess?

There is no need to place the ball on the strings, doing so extends your toss arm too far away from the body and leads to imbalance (your toss arm straightens and your body leans forward instead of keeping its weight on the back leg). The toss arm should be bent and relaxed, not stretched, it has a lot of work to do. The racket arm can benefit from stretching forward a bit more.

The ball will find its way on the racket's throat or bottom of the face, wherever you feel comfortable with it. If you're comfortable with it in the middle of the racket face that's fine too, but make sure it doesn't mess with your weight shift.

Simple Service Stance. Stand tall. Stand up. Shoulders back, relaxed. Taller. Point your racket to the net post to your side and WITHOUT extending the arms.

And before you begin exhale completely, let it out.

### **TO ROCK OR NOT TO ROCK...? THERE IS NO QUESTION**

During the serve process the weight goes forward, just like throwing or kicking a ball. Why not start with your body weight on the back foot? This idea moves you only in one direction, keeping things simple. Why rock back to the back foot to then rock forward to the front foot?

Many pros start with their body weight on the front foot, but if you're trying to improve your serve you need to simplify and that means starting with the weight on the back foot. Two things of note. First, the serve is the only stroke where we are standing still, we don't get to move to the ball. As a result there is no rhythm building for the stroke, standing still feels awkward. That's why you see the guys and girls bounce the ball on the court or bounce around a bit while getting ready to launch the stroke, or you see funny feet. They're trying to deal with the lack of rhythm. If they bounce the ball their weight will be on their front foot, and when they stop bouncing it their weight goes back onto their back foot and comes right back forward during the toss sequence.

Second, the pros get their body weight shifting forward during the toss, something that is lost on



students. Students often shift their weight back during the toss sequence instead of forward, losing the set-up for power. Why not eliminate the rocking motion to **simplify** your serve? Start on the back leg. If you work your serve this way you will eventually develop your own little back-and-forth-something-or-other rhythm filler, and all on your own without prompting from anyone. I can't tell you how your rhythm filler should or will be, you will find it all on your own. But I can show you the road to travel to find it.

If twist not, quack not, then rock not. Excellent. Be yourself.

Ready to serve? There's a pattern to follow every time.

See if your opponent is ready by only turning your head in that direction and not the upper body or racket and then return the head back to its starting position facing away from the opponent.

Exhale completely.

Look at the ball in your hand (can be optional).

Look up a bit in the direction of your toss, that is north of the horizon before you begin your tossing sequence ("arms down together"). The toss arm goes down and up and when you toss the ball the ball enters your field of vision. Point is don't watch the ball go down in your hand when the toss arm goes down and then watch it coming up, you lose your balance and rhythm. Look up first, then do the toss sequence.

Next: Holistic.

# Revolutionary Tennis

## Tennis Instruction That Makes Sense

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### Step 12

### The Serve

#### Part 2: Holistic

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Tennis talks about the "kinetic chain" of body parts "loading" and feeding to/from each other to produce power, or racket acceleration, not only for the serve but also groundstrokes. For the serve it works this way: the legs bend and load and feed the hips; the hips load and feed to the back and torso; the back/torso arches and loads for the shoulders; the shoulders rotate (internally/externally, not like a turnstile) to feed the arm, the arm rotates and the wrist snaps.

The concept of a kinetic chain is a linear one, that is part A feeds part B, B feeds C, C to D, and so on until the moment of impact occurs. Part A can not feed part C, so the thinking is if you miss or skip a link in the chain your serve suffers. For the serve you store or load kinetic energy in the larger muscle groups below the waist and then passing this, from one link in the chain to the next, up to the back, shoulders, and to the serve arm that ultimately takes the racket up to the ball.

While the idea of a linear kinetic chain is valid and is a cornerstone in bio mechanics if that's all there were to it more players would have great serves and great looking serves, but that is not reality. Something is missing. Arguably linearity is also there for the rest of tennis' strokes, but not for a tennis serve.

### REVOLUTIONARY: HOLISTIC

The manner in which the body develops itself for power (weight shift and loading) for a tennis serve should be viewed not as a chain of events but as a **wholeness**. Holistic, not linear. In fact both ends of the body (front leg and toss arm) at the same time (@ ball toss) work with the body's center (groin/mid section) to empower the swing (the arm extended behind the body). A holistic interpretation and not merely shoulder flexibility or loading and explosiveness explains why big guys who play football and baseball don't have the big serves and why slim guys like Ivanisevic, Sampras, and Roddick do. Holistic can explain why good servers are flexible in their shoulders, why they look so graceful, why they don't look like they're simply tossing the ball up, loading, and jumping up like a volcano erupting. Holistic explains why someone 180 pounds can serve 150 miles per hour into a box less than 60 feet away.

Holistic. Why? Because a bigger kinetic chain has never been the answer. The player with the deepest knee bend, the deepest back arch, the strongest/fastest shoulder extensors or the one with the highest jump does not hit the fastest serve. Many other players bend and arch more than Andy Roddick does, for example Joachim Johansson on the right, yet they don't produce a faster serve.



Definition: Holism: the view that an organic or integrated whole has an independent reality which cannot be understood simply through an understanding of its parts.

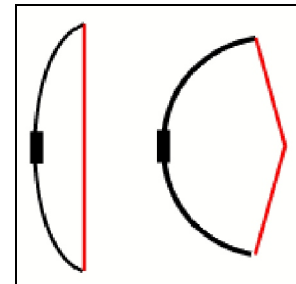
The body-as-spring or a pole vaulter's pole is a common metaphor when illustrating how the body works for a strong serve. You know, your pro asks you to bend your knees and spring up to smack to the ball, but watching a pro play it is very apparent the side of their body sticks out when the ball is up. Nick Bollettieri has coined the term "hip stretch" in his Sonic Serve video to describe this hip movement. Perhaps hip extension or side thrust would have been better for students because sticking your hip out to the side is not the way you stretch your hips.. It is not a matter of semantics, though, since "hip stretch" still evokes the linear kinetic chain and is not a holistic approach.

Tennisone.com coins the phrase "sink and bulge" for bending the knees during the toss and extending the side of the hip outward toward the net. Editor Jim McLennan describes: "As is obvious Roddick sinks and bulges much more than Federer. The bulge or arch can be likened to the energy placed into a bow to shoot an arrow. Andy's greater racquet head speed flows from this as much as any aspect of his serve." Jim is right-on with the application of a bow and arrow but unfortunately he passes the idea without notice because the linear kinetic chain ideas lie in a two dimensional flatland whereas a holistic point of view represents a new third dimension.

It wasn't until I prepared this Step that I found a metaphor that represents more what the body is doing in order to launch the stroke. This metaphor embraces the holistic idea and explains more organically why the side of the hip sticks out. And just as important students easily grab onto it and it is seen everywhere, no matter the level. Welcome to the Archer's Bow.

### ARCHER'S BOW

An archer's bow has a top limb and bottom limb to which the bowstring is attached, and between them in the middle is the grip. You hold the grip firmly in place and away from you, pull back on the bowstring, and the two limbs bend back and down. The characteristic bowed position finds the grip out ahead of the arched limbs, and with the bowstring pulled back and the grip held steady out in front the arrow is ready to fly.



This is what we do on a tennis serve, both ends of the body (toss arm and front leg) act together against and with each other to create force to launch the stroke that is between them. Why? To generate a lot of speed in a short time frame to hit a ball within a short distance. If the objective of a tennis serve were to launch the ball as far as possible, like a shot put or a javelin, while I would still use a bowing motion like a javelin thrower begins with I would emphasize an upward rotation and springing of both body and stroke like a shot putter. We, though, have to hit the ball down into a box 60 feet away, hence the application of our form is different.

I include photos of pros doing this Archer's Bow. If you look at the side of the waist, or hip, you can see how this area moves out and the toss arm and front leg mimic the effect of a bow's limbs. Rosset's photos are obvious, and McEnroe shows the finished look. It doesn't matter if the knees are in together or spread open, or if the stance is platform or pinpoint, the bowing effect is the big picture around it all.



The baseline in Ivanisevic's photos serves as the marker, you can see in the first photo his front hip is even with the baseline and moves beyond it in the second.

This bowing effect is difficult to see because most serve photos are not taken from the side. I include a montage here of Ivanisevic so you can see what his obvious bow looks like from 2 different angles.



Understanding what the Archer's Bow looks like from Ivanisevic's multiple views will help you see the Bow in the montage that includes Federer, Sampras, Henin-Hardenne, Roddick, and young up and comer Donald Young. Sometimes it's difficult to see the Bow from these different angles, but it's there.

As a result of the Archer's Bow the knees bend and the back arches, which makes bending/arching easier to do. I could easily say something like, "Bending the knees is a myth! Aching the back is a myth!" but that would be silly, superficial, and irresponsible. "Bending" and "arching" alone are difficult and I don't think helpful alone by themselves, but bending and arching are a subset of the Archer's Bow.

You see Sampras, or any really good server, appear loose, relaxed, flexible. Perhaps now it can be seen how relaxation and flexibility lay the foundation to achieving the Archer's Bow instead of setting the table for the linear kinetic chain.





Players often instead toss the ball, get the arm up there, bend the knees, arch the back, turn the shoulders, fire the racket, etc., and yet something's missing. You can get lost in the trees and lose sight of the forest. If you think of the one thing, the Archer's Bow, the rest of it can follow more simply and naturally. Give it a try and let me know.

## HOW TO ACHIEVE THE ARCHER'S BOW

First stand with your toss arm straight up above your head, and your racket arm down by your side. Then push the side of your waist, or hip, out to the side. Get used to the idea and feeling of bowing out, of keeping your toss arm held up straight and high, your front leg strong.

Second, incorporate this with the full stroke. Start with your body's weight on the back foot. As you shift your body weight from your back leg toward the front leg the side of your body bows out, simultaneous with the arms as they go "down together." Hold the position to develop muscle memory, arm up high, weight on front leg, bowing forward at the midesction. Here are three photos of me doing the Archer's Bow. This was taken with continuous shooting of the camera, though I am not tossing and hitting the ball. This is a simple explanation for you to follow, move the side of the hip outward and relax downward.



Your anxiety is going to rise from your waist line up into your chest when you shift and bow and lift the arms but it needs to go in the opposite direction, that is down into your stomach and lower body. Allow it to descend as your toss arm rises.

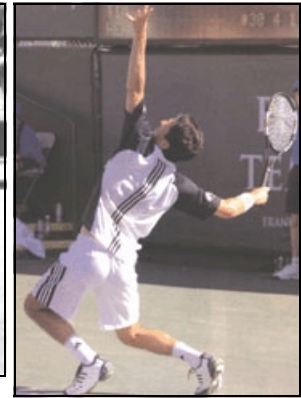


More than moving the side of you hip you are moving your groin area, or body center, to perform the Archer's Bow. Another way to look at it is you are moving your waist line. This weight shift is a small movement that gets lost with the bigger movements that happen later and take all the credit, but like with most things this small event is a set-up for what follows.

If I had to pick on thing to practice to enhance your serve, what would it be? There is so much to practice, isn't there, and never enough time to practice even some of it, let alone all of it. How about practicing one thing? How about head-to-toe gracefulness. Gracefulness produces a smooth weight shift and bow, a more consistent and full lift of the toss arm, a more dedicated approach, more confidence prior to contact. Practice for 2 months the gracefulness drill my coach taught me and get back to me about your results.



I include nice guy Tim Henman's serve for a look-see. His single photo Bow shows him with his knees very very bent, the back shin is almost parallel to the ground. He is being a good student, toss the ball and bend those knees. We all know Tim has a good serve but not an exceptional one. If he had he would have won Wimbledon, what with his great heart, footwork, toughness. He is not really bowing out like an archer's bow. If you compare him to McEnroe here you can see Mac is bowing more whereas Henman is bending the knees more. Mac's serve was more effective.



A Henman series illustrates what may have been his serve's weakness. He tosses the ball first and then catches up to it with the Bow. Rosset does it the same way, yet he has a bigger serve because he bows more instead of bends more. Tennis magazines write how it is proper to have



the body weight on the back foot as you're tossing, but the upcoming section on this will show how myopic that idea is. Tim's priority is the ball toss with the arm. Then he shifts his weight, bows, arches, bends. It is not holistic, or synchronistic, it is clunky. It is linear, done in sections, individually.

The serve. It's not about bending your knees. It's not about arching the back. It's not about springing up to the ball. It's

about something more, a bigger picture, where even the lowly ball toss is not just about putting the ball up there to hit but is an active part of the power set-up for the serve.

**The Archer's Bow.** Once achieved you will bend, you will arch, you will flex. You will have more. The Archer's Bow works only if you can hold it in place while serving. Once incorporated its power delivery can be amplified by twisting. It's not that important to do this, but if you want to delve deeper here's how.

[photo credits: Joachim Johansson Inside Tennis, March, 2005, GETTY IMAGES. Ivanisevic bow: TENNIS Magazine, September 1996, photo by Stephen Szurlej/TENNIS Magazine. Ivanisevic montage: center, TENNIS Magazine, April, 1993, I'm guessing photo by Stephen Szurlej/TENNIS Magazine; far right; USTA high performance newsletter, Vol. 4, No. 1/2002. McEnroe: from High Tech Tennis, Jack Groppe, 1992, photo by unknown. Rosset: Tennis Magazine, December 1994, photo by Stephen Szurlej/TENNIS Magazine. Large montage: Federer: TENNIS Magazine, October 2004, photo by Philippe Millereau/DPPI/ICON SMI; Sampras: USTA high performance newsletter, Vol. 7, No. 1/2005; Henin-Hardenne: USTA high performance newsletter, Vol. 7, No. 1/2005; Roddick: Tennis Week, March 22, 2005, photo Ron Angle; Young: Tennis Week, March 22, 2005, photo Ron Angle. Henman bow from behind, Southern California Tennis & Golf, May/June 2005, photo by Tony Chang. Henman series TENNIS Magazine, November 1997, photo by Stephen Szurlej/TENNIS Magazine.]

# Revolutionary Tennis

## Tennis Instruction That Makes Sense

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### Step 12

### The Serve

### Part 3: 3 t's: TOSS, TROPHY, & TWIST

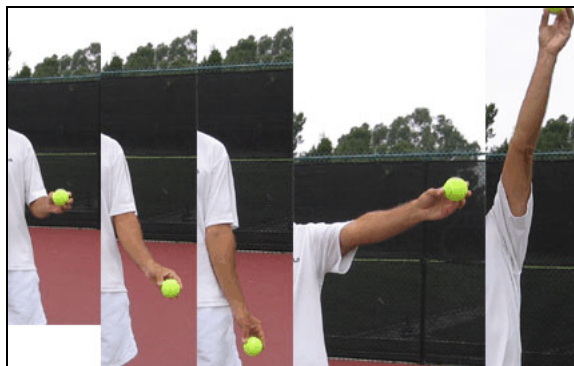
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First things first: the arms indeed go down together and up together during the serve. "Down together, up together" occurs. No one says "up together *evenly*." Both arms don't rise up at the same clip or reach the same height *at the same time*, duh, but they begin in sync going down and in sync they start going up. If not the back elbow stays too low and/or you bend the racket arm too soon. The arms are like two trains that leave the train station at the same time, branch off in their different ways at the same time and then travel at different speeds because they are not identically outfitted. To say "up together" does not occur is to say one arm hangs down at 6 o'clock motionless while the other rises. Poppycock.

### THE TOSS ARM

Just how does the toss arm work? Down straight and up straight? Down and back toward the racket arm and then up and forward to the net making a circular motion?

The toss arm works like a hand lever on a water pump, it simply goes straight down and then straight up retracing the same path in both directions. Straight down, straight up. Simple. Boring. The toss arm is bent holding the ball to begin with, then lowers to straighten itself before lifting up straight as a whole unit. [Here the arm unbends to straighten for execution, unlike the backhand where the mantra for the stroke arm is not to straighten when it bends/unbends, or folds/unfolds.]



Tennis personalities Vic Braden and Jack Groppe claim "proper" shoulder rotation for the serve is achieved by dropping the toss arm down and swinging it across the front of your body back toward the racket arm and then swinging it back up and forward to toss the ball, creating a roundabout circular motion. There is no evidence shoulder rotation is lost without a roundabout circular motion, just look at Pete Sampras, Gonzalez, or virtually any other great server. The fact the ball arcs on the toss back to the server or forward is no proof of a backward, roundabout circular motion of the tossing arm. "Proper" shoulder rotation accounts for why the toss arm moves like it does and it's not the other way around. Stefan Edberg is the one notable exception, his toss arm really does go back, but one example does not make the rule. **Revolutionary Tennis** shows how proper shoulder rotation is achieved without the confusing roundabout circular tossing motion, simplifying your efforts, and Vic's attempt to invoke a baseball player's

fielding/throwing motion to "prove" his point is sophistic.

How do you hold the ball? I was taught to hold it like holding a triangular paper cup where the ball pops up from between your index finger and thumb, but any old way seems to work nowadays and you'll find ample info on this elsewhere. But to add, the hand does not throw the ball up, you open the fingers and the ball is released. The momentum of the toss arm going up and of your body moving is how you "toss" the ball.

The toss arm itself works as a whole. There must be continuity, fluidity, and completion. A simple toss drill instills this in you.

You've heard the most efficient way to move an object is to move the center of the object. The middle of the toss arm is roughly the elbow, and I always picture my toss arm being pulled up from the inside of my elbow by a string like a marionette. In this way my arm is relaxed, straight, and lifting from the larger mass, the upper arm/biceps. Or you can imagine there is a hand cupping your toss arm elbow from beneath and it lifts the toss arm from that point.



Too often you will lift the toss arm from the hand and wrist as if someone from above had lassoed your wrist and was pulling it up. This can send your toss awry because the toss arm breaks, or bends, on the way up.

### THE TOSS FOLLOW-THROUGH

Did you know after releasing the ball your toss arm still needs to keep going up? Let me repeat that. The arm/hand keeps rising after you release the ball. Mucho importante.

The ball leaves your hand and the arm/hand keeps going up as both part of the lifting process and to prepare itself as the upper limb on your Bow. You don't let go of the ball and stop the arm/hand, you let it go and follow through up and you're gonna hold it like that before you swing at the ball. You've heard the term "toss arm up," right? Sure, for balance, direction, control, timing. But there's more, it's to set up the Bow. The more you keep it up there to work in conjunction with your lower body the better your serve could be. Just how it works to do that I'll explain in the very last section for the serve.



Yes, you may quick-toss the ball and not really keep raising the arm for a follow through but if you want to improve you need to either lift the toss arm higher or at least toss the ball higher to satisfy one of the original key demands: (more) time between the toss and the hit.

You (a right hander) toss the ball to the right of the service box into which you are serving. Using the net post on the same side is a good reference, tossing at one o'clock is good too, where



12 o'clock is the backhand corner of the service box into which you're serving. Point is, it's off the side a bit so you can swing around a bit instead of literally from behind your head. Of course you can toss the ball behind you and off to the other side and make it work to some degree or other but if you want to improve your serve just keep it simple.

You may find it helpful to your toss if you imagine a spring between your toss arm and the side of your body. This imagery I'm sure is found elsewhere. When you slowly drop the toss arm down to your front leg the spring is compressed and its release allows your toss arm to "bounce" up and rise faster than it dropped, in effect accelerating upward. Once you have started the toss sequence, that is once the toss arm begins to drop there is no turning back, there is no more thinking, there is no more caution or carefulness. The horse is out of the barn. Drop the toss arm fully and lift it right away because the deal is you're putting the ball up in the air to strike it, it's not about "how" the toss arm goes down and up (which explains why there are so many different looks in the pros with their toss arms).

You're not Pete Sampras, you don't have the attitude he has going into the serve so don't toss like him. Learn to toss how you're gonna toss. If you want to be like Sampras you'll have to grow into the form like just like he did, you can't start out that way. If you're a young junior hopefully you'll have a teacher who knows how to open new doors for you to stimulate your serve's growth. If you're an adult you know the value of working your way up to a certain proficiency, the time it takes, and the roles genetics and luck play. "A man's got to know his limitations," Clint Eastwood said as the character Dirty Harry in the movie by the same name. I think he was talking about his boss's obsession with trying to improve his tennis serve.

I've described the literal action of the toss arm, but since the serve is a symphony of body parts there is more involved to stabilize the toss.

First, look up in the direction of your toss, do not look at the ball in your hand and follow/look at the ball down as the toss arm goes down and then follow it up.

Second, focus on your stomach before you start the process, you're going to use the stomach muscles more than any other muscle group for your serve. While you will focus on your body center (groin) and move it to be efficient and balanced it will be your abs in particular which form the foundation for the serve. Unlike groundstrokes your body center on a serve works to keep you balanced statically since you are not taking steps, this leaves you free to concentrate more exclusively on the stroke itself (unlike groundies where you have to focus more on approaching the ball, balancing actively, adjusting the stroke for timing).

Third, move larger muscle groups to control the smaller muscle group which is your toss arm. Moving your body head to toe first (using abs and groin muscles) will help you control the toss arm to a great degree. It's not like you're standing still pitching horseshoes. You're going to shift your body weight and go into your toss motion. It's very hard to stabilize the toss by isolating the toss arm by itself, we don't toss and then shift the weight. The toss arm works with, and off of, the moving body. I've been noticing how advice on the toss goes something like this: from tennisonline.com: "Both players (Roddick and Federer) release the ball with their weight on the back foot..." [photo from tennisonline.com]



On the near right, from the USTA High-Performance Coaching, Vol. 7, No. 1/2005: "Picture 1: Here we see all three players beginning their service motion with their weight being transferred to the back foot and the tossing arm moving upward to the right side of the body."

On the far right, from the USTA High-Performance Coaching, Vol. 4, No. 1/2002: "As the players start their action and toss the ball up, their weight is primarily on the back foot."

They all say you move the arm upward or release the ball with the body weight on the back foot.



Hello! Reality check! The body weight is going forward for the most part when the toss arm starts going down and at the very least when it starts going up. You don't release the ball with your weight 100% ON the back foot - yikes! - the weight is being transferred forward onto the front foot during this process as you see Ivanisevic on the right displaying, his front toe that was up is going down. The analysis in Ivanisevic's second photo above opines as he "toss(es) the ball up" his "weight is primarily on the back foot" is directly contradicted by the larger sequence beneath.



Some pros, like Tim Henman, for example, continue shifting their weight forward after the ball's release, but does this mean the body weight is on the back foot at the release point since the body weight is not transferred 100% onto the front foot by that time? No señor. Do you say a horse is floating in the air because all four hooves are off the ground in a single photo? No señor. And of a photo of a human in mid stride, do you say humans walk on one leg at a time? Ay señor.

## ADVANCED

The toss arm lifts and becomes the front limb of the bow, where the bottom limb is the front leg. Together their rigidity as a whole will empower the slingshot effect of the bowstring (racket arm), i.e. keep the toss arm up. Obviously the arm's muscle group isn't as strong and thick as the front leg's, so it has to work a little more to allow the racket arm to gain benefit from the tension as it "pulls" the racket back. Keeping the toss arm up is not a passive thing to do for balance and direction, it helps you to swing faster and lift you up to the ball. More on this in my last section.



## TROPHY

No matter if you have a low toss or a high toss you reach a point during the sequence that's called the "trophy serve": the front toss arm is up and the back arm is lower, racket held up. You can see this in the montage on the right, with Henin-Hardenne, Pancho Gonzalez, Federer, Sampras, Ivanisevic.

Vic Braden, in an August, 1989, TENNIS magazine cover piece on the serve, "Braden Shatters Serving Myths," tries his best to make us believe the trophy serve is a "myth" (Vic small photo right). He says we all incorrectly mimic this look on our serve that "destroys the continuous swing that you seek on the serve." He claims the tennis trophy sculptor "wanted a certain look, he had the server raise the toss arm while dropping the elbow of his racket arm."

Of course Vic exaggerates when trying to prove his point, as seen in his photo with his elbow dropped really low. A real tennis trophy he rails against does not look that way at all. And some of the pros in the montage above right have their elbow low and their toss arm up...? Hmm. Maybe he's saying the tennis trophy is wrong since there's a ball in the toss hand and not in a player's hand when the toss arm is up. Wait, that's the second ball...

For Vic the trophy serve is a no-no, along with the high toss. A high toss indicates a player needs more time to hit it because of "hitches in their service motions that delay their swing."



Vic invokes John Newcombe as an example of a proper serve, but the photo on the left shows Newk in a trophy serve. And his back elbow will drop from this point before striking, just like with Rafter or Roddick.

The trophy serve is inescapable, even for Vic, whose form from the same article I also include on the right: his tossing arm is raised above the level of his racket arm, the back elbow is dropped.

Vic opines the trophy serve leads to dropping the racket arm elbow and destroys the continuous motion. Oh, the uninitiated. Your elbow drops precipitously if you bend your racket arm too soon out of the gate, that is you must let the ball rise a good bit first while continuing to lift the racket before cocking the arm. Down together, up together, you see. You can't blame a low elbow or a lack of a continuous motion or hitches on the trophy serve, it doesn't add up if you look at the pros. Calling the trophy serve a "myth" and that it has "ruined more serves" is to do all students a



disservice and hurts the game.

The question is how much time do you need between the ball release and contact. Do you toss to the height of the outstretched racket and hit the ball after it has dropped a few inches, or do you toss it higher than that before hitting it? Considering one arm drops and lifts straight up to release the ball in front of you, which takes little time, while the other drops and goes back and lifts up and bends and unbends and reaches up and forward to meet the ball, which takes more time, I think the answer is obvious. Toss it higher than the reach of your outstretched racket.

I was taught to hit the ball at the apex of the toss but I don't think I really do that. I know if I hit it while it's descending I get more action on it. Jimmy Connors comes to mind of a pro with a low toss, and a couple of others, but I found a good clip on

tennisone.com to calculate his ball toss height. From slightly above but looking parallel across the court we see his ball<<< rise (photo right) above the head of a seated adult male spectator in the near background to the left with the white baseball cap and the ball drops to below his chin at contact. My guess is 12 to 18 inches of drop.



A low toss means it's barely high enough and your swing has to catch up to the timing forced upon it. Rushing is not a good idea when it comes to tennis' most difficult stroke, the swing itself needs time to develop because it has more to do than the tossing arm. If you're like most players you really aren't hitting the ball as well as you'd like to because your toss is on the low side, every student always begins with a toss that is too low and teachers have to work them into tossing higher. Hence the toss can't be "low" if you want to improve your serve, toss higher.

If you toss the ball too high there will be a pause at the trophy serve position, the racket actually stops, something you see occasionally in the pros. This doesn't mean it's a bad thing to do, pros are successful with it, but it's more difficult to work with. Is it better to toss it too high? Nope. Is it better to toss it low? Nope. Is it better to toss it high? Yup.

Vic's science fact against a high toss says that a ball tossed 6 feet above the impact spot accelerates down through the timing window at 4 times the speed of a racket-high low toss and thus makes it harder to hit. While technically accurate in the real world it's specious. Who asks a student to toss 6 feet higher than the contact spot? And though the ball spends less time within the timing window from any toss higher than an outstretched racket it gives you more time to hit it. Take the time, but don't dillydally.

It's not toss height that counts but the time between the release of the ball and contact, the time your swing and body need to develop. Hey, if you've got a quick strike then go for the lower toss, you'll be the exception. But if you want to go faster than the equivalent of 40 mph on the freeway, you will need more time between the toss and the hit.

## TWIST

Come on baby, let's do the twist. Come on ba-aby... Wrong twist.

Big secret here, but it's an easy one. You toss the ball, the toss arm goes down and up; the racket arm drops and rises. You know this. Now turn the back shoulder sideways more -- and keep that toss arm out in front where it's supposed to be. Voila, you now have "proper" shoulder rotation being set up and you didn't have to start out convoluted and take the toss arm back, down, and up.

The hips do not turn sideways more, just the shoulders, as shown by Boris Becker on the right. The hips hold their position while the shoulders "wind-up" above them, and by holding their position you allow the shoulders to release their wind-up best. No hip rotation here, their contribution is more vertical. The hips are all about aggression, not rotation.

If you start with the Simple Service Stance the neutral position of your shoulders means they are already turned to match the rest of your body which is turned to the side. But the shoulders will not be turned to begin with if you start from the Stance In-Conflict, they will be open, and this means you have to get them back (re-turn them) to a neutral position before tossing. All that extra stuff makes your serve harder to do.

At every level the shoulders should close, or turn, in the sideways direction, **during** the toss, but it's not about moving both shoulders, or about swinging the toss arm back to help you "turn." It's the back shoulder that closes more. Sure, you can think about closing both shoulders, but this can lead to your toss arm going awry too easily, even though it will when you first practice closing the back shoulder. Opposite directions here, toss arm one way, racket arm and back shoulder another. This is the beginning of the Spread across the pecs, which others have talked about and is right-on.

Think toss the ball ahead of you with a simple down and straight up motion of the toss arm while at the same time you close/turn the back shoulder more. Easily achieved from the Simple Service Stance.

## SEESAW

Simply stated, since the front arm goes up higher and sooner than the back arm you adopt a seesaw effect in the shoulders where the back shoulder is lower than the front. The seesaw goes the other way when the racket arm delivers the racket up to the ball - but just the shoulders, the front toss arm stays up as long as it can, and when it drops it does not drop to hang by your side, the forearm remains up.



## PHOTOS:

Trophy Montage: Sampras, Feder, Henin-Hardenne, USTA High-Performance Coaching, Vol. 7, No. 1/2005. Ivanisevic, TENNIS Magazine, September 1996, photo by Stephen Szurlej/TENNIS Magazine. Pancho Gonzalez, the International Tennis Hall of Fame, tennisfame.com, and the bio on him is courtesy of Bud Collins' Tennis Encyclopedia, our famed tennis beat original.

Vic Braden: TENNIS Magazine, August, 1989, photo by Dom Furore/TENNIS Magazine.

John Newcombe: from FAME, a hardcover compilation of tennis greats edited by Eugene L.

Scott of Tennis Week; photos provided therein by the International Tennis Hall of Fame,

additional ones by Ron Angle, Patricia Barry, Michael Baz, Jeanne Cherry, Michael Cole and Le

Roye Productions, R.T. Combe of Earnshill, Melchior DiGiacomo, Art Seitz, and The Wimbledon

Lawn Tennis Museum. Becker, TENNIS magazine, July, 2005, photo by Paul Zimmer.

# Revolutionary Tennis

## Tennis Instruction That Makes Sense

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### Step 12

### The Serve

#### Part 4: The Upward Swing ↕

#### The Flight Of The Tennis Racket

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Before we can fly we first need to talk about the elephant in the room. When you hear or read about the back scratch on a serve, what does it mean? Is it real, or is it a myth?

If you hold a pencil above your head and I mention the two words *back scratch* to you I bet you would reach down behind your back with the pencil. Now with this same pencil down behind your back, if I mention the words *back scratch* would you throw the pencil up to the ceiling?

Unfortunately students are confused regarding this simple how-to metaphor, and confused students leave the game. The loud voice behind this confusion is a licensed psychologist, self proclaimed tennis scientist, and one of our most esteemed celebrity tennis teachers.

Vic Braden keeps telling us to: "forget the back scratch... the worst thing you can tell a player learning to serve is, "Get your racquet down behind you and scratch your back,""...you should not try to lower it [the racquet] in an attempt to scratch your back." (all in TENNIS magazine, 1989). In 2001 in Tennis Week magazine (tennisweek.com) he believes it is a "myth" for the "tennis server...to scratch his back...while reaching upwards with the racquet." Racquet down and scratch your back, scratch your back while reaching up with the racquet.... Confusing, and then declaring the whole kit and caboodle "a myth"? Fire and brimstone!





## NO CONFUSION

The back scratch metaphor developed to help you drop the racket down behind the back in a tear drop fashion to avoid placing the racket in the dreaded waiter's tray position, photo right. After you do the racket "down and up" part too often the hand lays back, leaving the racket face facing up like a waiter's tray, instead of moving to place the racket down behind your back (more later).

The racket never touches the back on the way down or up. And there is absolutely no way this metaphor developed to help you swing up on the serve because *everyone* knows that swinging up is similar to throwing a ball. That's the metaphor we use for the upward stroke, UP like throwing a ball. What would you say to the student to avoid the waiter's tray problem, "salute" with the racket? Gimme a break.



There is no fight or misunderstanding in the greater tennis world over when and where and why on the back scratch for the serve. It's for getting the racket both behind and down the back

James Dean was an actor, Jimmy Dean is a sausage. Buh-bye elephant.

## RACKET ARM BALLET

Our tennis arms look kind of funny, or odd at times when we serve, don't you think? There's this bending of the wrist, relaxing of the arm, the coordinated drop and lifting of both arms, spreading the chest, separating the arms, keeping them together. The racket seems to be held lightly in a pro's hand and yet it moves up faster to the ball than Billy the Kid's gun leaving its holster. It's balletic, and there's a choreography to it, but first the reason for this form.

## AERODYNAMICS ► ACCELERATION ► POWER ☺

Acceleration is power, and pros make the tennis racket fly on a serve by moving it through the air on its edge for as long as possible before hitting the ball to minimize drag. Only just before contact does the racket face actually turn to face the ball. The dreaded waiter's tray scenario will short-circuit this process and abruptly grounds the stroke. Of note, all other strokes encounter wind resistance during their setup and forward stroke, thereby necessitating a certain degree of strength to move the racket fast. On a serve we get a break, we can make the racket slice through the air by moving it on its side. Which is why the serve set-up seems effortless.

In the montage right I have a white piece of paper attached to one side of my string bed, facing you, and a red piece of paper to the other side, the hitting side. Reading from left to right, I draw

the racket down like a pendulum, the racket slices through the air (Andy Roddick notwithstanding). I bring the racket back and up on its edge as much as possible and you now see the red piece of paper on other side of the string bed, I executed a small turn in the hand which turns the racket face. This turn of the hand is minimal and leaves the racket on its edge again so it points up

to the sky -- OR you can keep turning the hand and (incorrectly) lay the racket back in the waiter's tray position. If you lay it back future acceleration is lost, as well as your ability to impact spin designed to help the ball dive down into the service box.



The racket moves into the back scratch position if you avoid the waiter's tray. The racket face slides back behind my head, the knuckles of my racket hand move towards my ear and head, the racket face is not turning or laying open (you see the red paper side). The racket drops down in a tear drop fashion behind my back and it is here, one more time, that the dreaded waiter's tray move must be avoided. To be successful the racket comes up from behind the back on its edge, you now see the white piece of paper on the non hitting side of the racket, you don't see the red. It is only at the end the racket opens up/faces (red side) to hit the ball (illustrative in my example, the racket turns sooner, see Graf right below).

The waiter's tray can also happen out of the back scratch position if the hand opens the racket face first and then you lift it up, photo right. Instead, lift up first on its edge.



I include some photos of pros where you can clearly see how the racket remains on its edge going up to the ball until literally just before contact. Emerson, rocket Roddick, Sharapova. Graf, second from right, has just begun turning the racket face into the ball.

It's as if your racket were an ax or a tomahawk and you're going to drive the



edge into the ball but at the last minute you change your mind and hit it with the flat face. Actually practice trying to hit the ball with the edge of the racket first, a little tomahawk style, and then later do the same but open it at the last minute.

## THE WAVE

To keep the racket on edge during the swing the hand does a waving maneuver. The hand doesn't lay back like shooting a basketball to shoot the racket face to the ball, if it does you are doing the waiter's tray thing. The hand instead waves back and forth to wind up and then throw the racket in the same manner as if pitching a baseball. The third source of serve weakness for most tennis aficionados, the first being shifting your body weight backwards when the arms go down together and up together, second bending the racket arm too soon, is opening the racket face way early. You need to keep the racket on edge for as long as possible, and you open the racket face only right at the end.



Think racket up on its edge, down behind the back on its edge, and then up on its edge.

Though a pro most likely developed his serving motion in the womb, point is your hand needs to perform this waving maneuver if you want the racket to fly. As a historical note, perhaps this is the main reason why the game of tennis has always been associated with the elite. This waving maneuver is essentially the royal wave as performed so brilliantly by the members of Britain's House of Windsor. Which begs the question, which came first, the tennis wave or the royal wave?

## LEARN TO AVOID THE WAITER'S TRAY

Stand 6 inches away from the fence and with your back to it like I'm showing below in the photo sequence. Do the "down together, up together" with the arms and notice how your racket bumps into the fence behind you (photo 3 left to right), it's acting as a vertical plane to prevent your racket from laying back in your hand (waiter's tray position). Practice this to develop the muscle recognition, at times sliding the racket down behind your head and down the back behind you. The idea is to control and redirect the racket's momentum away from laying back behind you (into the fence) to keeping itself even with your body (away from the fence). It's as if your intent were to make a circular motion in front of your body with the racket arm (two photos right) but of course it goes down behind your back.







Another variable to learning this form is the commonly known **praying mantis** position of the racket arm as it's rising. Here the wrist is bent so the racket hangs a bit in an opposite direction to

effective kill the possibility of the racket laying backwards in the hand (cuz of momentum) and the hand opening up. This bent-wrist position is evident everywhere. If you focus on moving your hand down and up instead of moving the racket you can achieve the bent-wrist position. Think of your hand/wrist being pulled up by a string like on a marionette, it helps keep your wrist loose and flexible in order to avoid the waiter's tray and keep the racket on edge.

Your hand and arm are in control of where the racket's going, the racket is not in control of your hand and arm. No Dr. Strangelove tennis rackets here please.

## OVERKILL

My generation was taught to throw old, heavy wooden tennis rackets over the net to develop the serving motion. It's not easy when you're a kid to launch 14 ounces over the net from the baseline, but you could if you turned the racket on its edge, broke the wrist, and threw up. Throwing, and up, is the analogy for the upward swing.

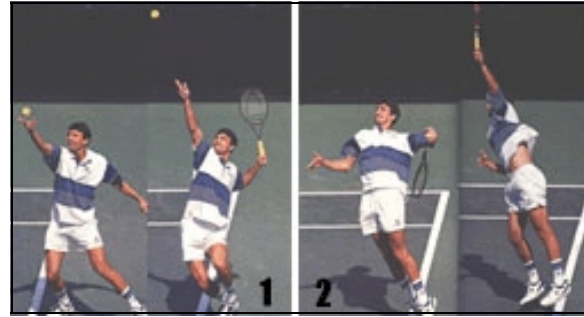
I think too often students merely swing the racket with just-enough acceleration to get *the light and small ball* over the net. Something is missing in your approach to the stroke. Throwing a heavy racket over the net as a kid taught me that swinging the hell out of the racket was primary, the hitting of the ball was secondary. The Holy Grail to the serve is swinging as all get-out.

Overkill. Bring the elephant gun to kill the ball. Swing more than it would take to merely get the ball over the net and into the service box at a decent pace, puh-leeze! Don't worry, the ball will go in when you change the swing trajectory, change the grip, and use your wrist and arm better during the contact (upcoming). But-you-need-to-swing! At-the-dod-gammed ball! Come on!

Once I could easily throw a wooden racket over the net and serve relatively hard my tennis coach François Savy taught me an acceleration drill really pumps you up.

## THE LOOP: 2 BEATS

Exactly as with a forehand groundstroke the serve stroke uses a loop when the stroke prepares and then swings (down and up) at the ball. This also implies two beats to the stroke, it is not all one continuous motion *at the same speed*. A groundie starts the loop "racket up" and the racket moves behind you while still held up; a serve starts its loop "racket down and up" (#1 in photos) and the racket creeps to behind your head but the arm does not fully bend or cock to throw. A groundie hits the second beat by dropping down behind you and immediately going up to hit the ball, a serve drops the racket down behind the back and immediately goes up to the ball (#2 right in photos).



Here's the second quicksand trap on a serve. First is the weight shift, second bending the arm too quickly, third the waiter's tray thing.

Too often tennis aficionados will have their arms go "down together, up together" but then immediately fully bend the racket arm. You (toss and) fully cock the arm while the ball's still going up, leaving the arm motionless. Effectively you've lost the springing potential of the arm, much like on a groundstroke if you drop the racket too early and the arm waits, dead weighted, with the "racket back."

While there is a continuous motion of the racket arm the continuous motion is not at the same speed. This distinction between the serve's two beats on the loop means acceleration. Often this distinction makes it seem there is a pause, or a stop, in the serve motion, but there isn't. There is a pause only when the toss is way too high. All pros have a continuous motion with the racket arm, the exceptions are few, but no one keeps the same uniform speed throughout.

For the fundamentally minded, when the racket goes down behind the back and then up to the ball the racket makes a looping motion of sorts behind the back, like a number 8 but missing half of the top circle. It doesn't go literally straight down and then straight up as if it were an elevator, but describing this small quasi looping motion to students doesn't seem to affect them in a positive manner. This motion is a no-teach thing, it comes all too naturally and if you point it out it gets confusing. Describing the bigger picture of the overall rhythm of the serve as a loop with two beats similar to a forehand proves beneficial.



## BUTTS UP

With the racket down the back, how does it go up to the ball? Butt cap first. And like a rocket taking off. The body doesn't go up like a rocket, the racket does. Sure, fundamentalist interpretation would say it's a myth the racket goes up butt cap first since you don't hit the ball with the butt cap and photos show the butt cap is turning down on the racket's way up to the ball. But while strictly correct I don't first focus on flipping the racket face up to the ball, I focus on the butt cap and the racket goes up on edge.



There you have it. The **loop**, the **wave**, the **backscratch**, the **butt cap**, and **overkill**, all designed to help you **throw** the racket **up** at the ball as **aerodynamically** as possible throughout to maximize racket **acceleration**. That's why we do that funny ballet thing with the racket arm, it keeps the racket **on edge**.

Two things to avoid: the waiter's tray and bending the arm too soon. If you can your timing and swing will grow into itself. The toss arm goes up softly, fully, the racket arm has to get the racket up, then down the back and accelerate up to the ball. How best to do this? Toss the ball higher to have enough time for it all, which means you avoid the just-high-enough toss. See how it all ties in? Geez, there he goes again...

Next up: **Contact: Use the body to hit the ball better.**

[Photo credits: Backscratch: Stich, TENNIS magazine, 11/93, Stephen Szurlej/TENNIS magazine; Federer, USTA newsletter, Vol. 7, no. 1/2005; Serena, LA Times, 08/27/02, Agence France-Presse. Edge: Emerson, uncredited from web site; Roddick, Inside Tennis, 07/05, Getty Images; Sharapova, uncredited from web site ; Graf, TENNIS magazine, 05/97, Stephen Szurlej/TENNIS magazine. Loop: Ivanisevic, TENNIS Magazine, September 1996, Stephen Szurlej/TENNIS Magazine. Praying Mantis: Roddick, LA Times, 1/18/05, Greg Wood, Agence France-Presse, Getty Images; Venus, Tennis Week, 6/27/02, Art Seitz; Sampras, USTA newsletter, Vol. 7, no. 1/2005; Agassi, uncredited from web site. Butt cap: Serena, TENNIS magazine, 06/99, Mary Schilpp/CLP ; Rusedski, Rios, Ivanisevic, USTA newsletter, Vol. 4, no. 1/2002.]

# Revolutionary Tennis

## Tennis Instruction That Makes Sense

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### Step 12

### The Serve

### Part 5: The Incredible **U**<sup>**P**</sup>ness of Contact

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All right. The bow is dialed in, the toss arm is well up, the ball begins to descend, the body starts to shift its weight to help accelerate the racket. Now what the hell do you do?

Don't look at the bird up there.

Here's the hard part, you have to wait for the ball and go to it. Rhythm is absent because you're standing still, you don't get to take steps or move the feet. It's a bit like playing golf, but you don't have all the time in the world. Bummer.

### USE THE BODY TO HIT THE BALL BETTER

The skinny is this.

1. During the swing the back shoulder and arm **leapfrog** up over the front shoulder and arm, the shoulders don't rotate around like when throwing a ball. I prefer leapfrog instead of "cartwheel" to describe this process because on a cartwheel, which is round, when one part of it rises the other part lowers, like a seesaw. On a serve both sides of the body need to remain up, and the front arm and shoulder need to learn what "up" is for them.
2. The **body**, as with the swing, **goes up** to the ball that's up in the sky and not forward into the court. Even net rushers go up first, they land down close to the baseline only to then refocus forward to the net. But going up is more than leg drive.
3. The toss-side **front half** of your upper body - your toss arm, shoulder, and pectoral muscle - need to **remain up**. Yes they will drop, duh, but they will drop precipitously if left on their own. Your abs will help here.
4. The body unbows as a whole and to some degree unwinds the shoulders and torso (even though the shoulders leapfrog). It is far too easy to rotate open (baseball pitcher) or lay out the shoulders (discus thrower, cricket bowler, jai alai player) and catch too much air (slows the racket arm down) and overcommit the body (messes with racket trajectory). We actually **go sideways up** and into the ball, it's a bit like being underwater in the shallow end of the pool and when you break the water's surface for air half your body is "sideways" out of the water. Or perhaps you like the coin slot metaphor better, where you're pushing your shoulder line and torso up through an imaginary coin slot beneath the ball. This is an instructional metaphor, pros take this a bit further and not so literally.

5. You **swing up** to hit up over the net much like a basketball player shoots up over the height of the rim to make a shot. The swing is not a line drive down into the court. The idea is there is something like a funnel upside down above you overhead where your swing does its thing within the wide mouth of the funnel to ultimately narrow its focus up and into the ball. A simple drill for hitting up illustrates.

6. For contact your body **remains turned** and should not (open up and) face the net like a baseball pitcher who faces the catcher when releasing the baseball. During the serve you are in the process of opening and will open fully after contact, yes, but for contact you are not facing the net head on. Try to hold that position as best you can because the path of least resistance is to open prematurely. You are not literally sideways while striking the ball, that's awkward and impossible (comment for tennis absolutists), but you get the point.

7. We are swinging up to the ball but we're going to bring the ball down into the service box and not hit it up to the clouds. The form to achieve this leaves the racket arm in a crooked position and not extended out straight towards the opponent's service box. Yes, it straightens/extends up during the hit but we're not moving the arm towards the opponent like a baseball pitcher moves his arm towards the batter since ours goes up to the ball with a long stick in our hand. The arm sort of turns into a **pretzel** because you will both snap and pronate both forearm and wrist. Emphasis on the wrist snap, but a wrist snap for tennis players is different than any other sport's wrist snap (more later).

### **FOLLOW THE SUPERIOR SERVE ROAD**

The coordination for the serve is very difficult, students often relate they feel like a puppet on a bunch of strings. True, but you are also the puppeteer. Assuming the bow is dialed in and the pecs are spread well there is one master string that allows for the rest of you to fall into place more or less. Coming into communion with this master string takes you down the Superior Serve Road.

One end of this imaginary puppet string is attached to your center, below your navel. It travels up through the abdominal structure and middle of your torso and exits your body at your sternum. It is this imaginary string the puppeteer (you) pulls up. What happens is your sternum rises and you look like you're being pulled up on the rescue winch of a U.S. Coast Guard helicopter. Much like in ballet and other jumping disciplines it is not so much the legs that push the body up but the center and midsection of the body that lift the lower body first and then push what's above.

This is clearly seen in the better serving pros. The photos of Andy Roddick and Pete Sampras illustrate this best. While everyone else posits the legs pushing off against the ground gets the body up for a great serve it doesn't work the same for everyone who "does it" this way.

**Revolutionary Tennis** fills in a missing link to help deliver the Superior Serve: abs-to-sternum lift off.

## STERNUM LIFT

The Sampras sequence below shows this sternum lift-off well because of his shirt's horizontal stripe and the sidelines behind him. First focus on the middle of his shirt, at the gap in the stripe, it starts out as even with the singles sideline and then rises markedly above it, it does not remain in place like the middle of a seesaw and you don't see the stripe merely seesaw. [Yes I know his legs are driving up, but there's more to come, and yes, the elbow pops up, or triceps, but that's been exhausted to death and is not a main engine.]



Courier, below left, and Roddick continue this sternum lift-off idea. Leg drive alone never explains how the body works in athletics, the major components for performance are the body center and the abs. Even in football, driving with the legs is never enough for linemen, learning to drive from their center and stomach muscles empowers the body more (i.e., better posture). Tennisone.com offers Andy jumps off both feet while serving, what they call a "dual leg drive." Andy, like all other servers, jumps primarily off one leg on his serve, the front one, he does not use both equally because he is neither a basketball player nor a 'roo, mate (though I bet he boxes really well). The back leg will push into the front one for extra assist, but the front one is the main engine in this.



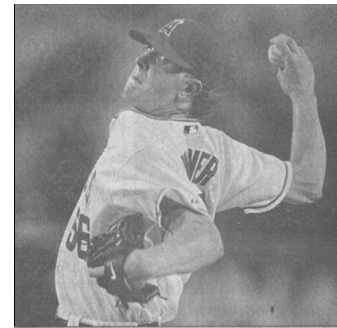
The legs alone do not drive, the body's center lifts as well. Add to this an upward swing and the lifting point rises up through the chest and tennis pros with Superior Serves markedly rise up from their sternum before hitting. Pros without Superior Serves tend to move the torso toward the net in a misguided attempt to help "oomph" the ball more, they cartwheel, or seesaw, their shoulders, looking a bit like a jai alai player with a scoop in their hand. Pros without Superior Serves don't rise up much at all, and often their toss arm will drop too much.



On the right is Tim Henman, top, Goran Ivanisevic below, who has been changed to right handed instead of his natural lefty for comparison. You can see Goran really pops up from his sternum whereas Tim Henman uses his sternum as a pivot point around which the shoulders and arms move like hands on a clock. Henman does come up but he quite obviously is moving forward and over like a cartwheel (or seesaw), whereas Goran is going nowhere but up. Henman's front arm is already lowering whereas Goran's is held up, way up in fact, further manifestation of the incredible uPness of contact. [Goran's swing timing is milliseconds behind Henman's, but there's no chance Goran's going to look like Henman milliseconds later.]



Major league pitcher Jered Weaver's sternum pops out in the direction of his release, the batter in front of him, ours pops out in the direction of our release, the contact overhead. Weaver's sternum moves forward to the batter, ours moves up to the ball. Yes, the spread in the pec muscles lays the foundation for this, and it's been covered everywhere else. But once spread, what part of the body should you focus on? Not the arm.

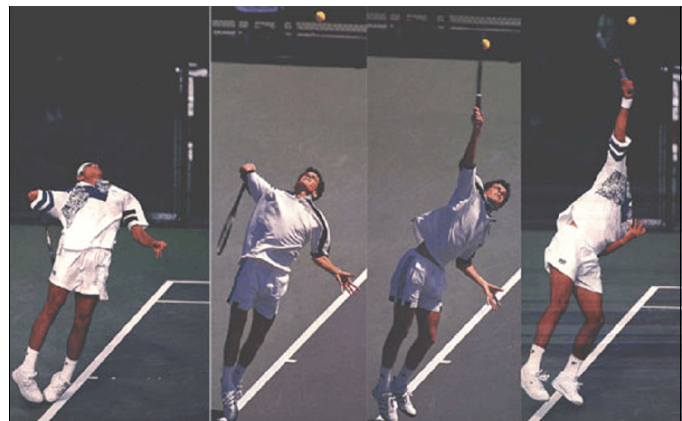






The background here for Rios, top, and Goran, bottom, displays how "up" each one gets, how each one either rolls the shoulder over or rises up, and how well the front arm and hand stay up. Rios rises from photo #1 to #2, judging from the letter "O" in the background, but in photo #3 he remains at the same height. Not so for Goran, who keeps rising in #3. Rios in #3 seems to already be coming down even though his head remains at the same height, possible because his shoulders have cartwheeled, or seesawed over with his sternum as the pivot area and making him look like he's swimming toward the net. Goran, by contrast in #3, shows no cartwheel pivoting but instead, again, is primarily up in his sternum. Rios' toss arm in #3 has come down too much, it is below his waist, compared to Goran's. In the #4 photos the front arm stays up, which may be Rios' saving grace.

Mark Philippoussis here (ends) and Tim Henman (middle two) show two viewpoints again with the cartwheel sternum-pivot distinction and the front arm during contact. Mark is up whereas Tim's goes forward and over, Tim's toss hand drops far too much before contact and at contact.



Equally important to help you go up and stay up is using the front half of the body to achieve this. I'm sure scientists can explain better how counterforce enhances the slingshot or arrow delivery ideology, but using the large muscle groups in your chest, abs, and rear shoulder help to produce the Superior Serve.

All the photos above can be used to illustrate this concept. Rios and Henman are not keeping the front half of their body up and in on the action as much as Ivanisevic and Philippoussis. I believe Philippoussis achieves this through talent and his overall strength, Ivanisevic through preternatural talent. Sampras and Roddick are equally out of this world in this incredible uPness of contact.

## THE FRONT HALF OF THE BODY

Sampras keeps the left half of his body up throughout the serve, not only can you see it in action but his front toss arm, by staying up so much, is a dead giveaway. Bear in mind the swing forces the front shoulder and arm to drop. If to the best of your ability you don't give in to the path of least resistance your serve improves.

The front half of the body is this: Draw an imaginary line from behind your neck down your spine to your waist then around your waist on your toss arm side and to the front to your belly button, then up the middle of your chest to your collarbone. This is the front half of the body that works to remain up, *independently*, from the rest of you during the swing (outlined in photos on the right of Sampras and Rosset).

Of course don't forget to keep the toss arm up in all of this, it needs special attention. As Rios shows above keeping the toss arm up helps even if you're not keeping the sternum up during the swing.





A popular website with deep analytical skills uses Roddick and Federer (right) to show how the "Left Side" works on your serve: "The swinging left arm contributes to the rhythm, power, and balance of the service delivery (as well as a pitcher's baseball delivery). When in rhythm, there is more or less a straight line from elbow to elbow as is the case with Federer on the right and as we would see in Sampras' or McEnroe's delivery as well."

A "swinging left arm" does zip for incredible upness, and regarding "rhythm, power, and balance of the service delivery" the pecs, shoulders, and abs are larger muscle groups that will contribute in greater part to achieve this than a "swinging left arm." Though of disproportional importance the toss arm can lead the rest of the body astray, like a bad apple spoils the whole bunch.

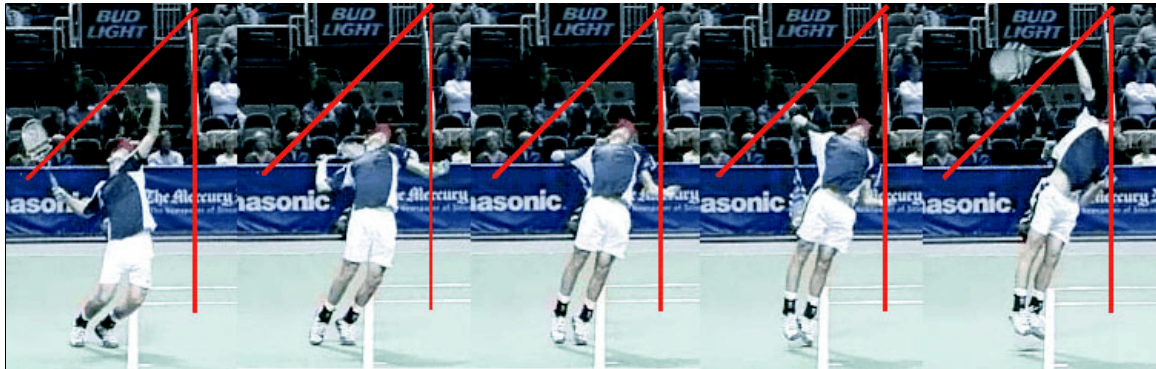
Next photo, same Site, uses a yellow arrow to show the hitting elbow "pulling up" to the ball as a major component to the stroke. The only way this small body part performs is if something larger leads the way and supports it, as shown by the larger arrows offered by **Revolutionary Tennis**. You lift from groin through sternum, and remain turned for contact, and then the stroke can hit those common markers pointed out by so many. It is that simply understood.

Federer and Roddick simply are not thinking about some necessary straight line from elbow to elbow - in a millisecond that serve elbow pops up, so why? Neither should you. What they are thinking about is "do it," and what they have been trained to "do" is to get up to the ball, both body and stroke. And this you can do as well: Toss arm uP, uP from the sternum, left side uP, butt cap uP to reach uP, head uP, snap uP. uP.



## FUNNEL

Tennis servers are not trying to split a tennis ball with the racket like a coconut with a machete. If so our swing would look different, it would paint a much larger arc and the racket would remain more in line with the arm and hand. We want speed, acceleration, quickness. A quick strike. Like a pair of nunchuks the racket snaps up to the ball: The forearm becomes one handle of the nunchuks, the racket the second handle, the wrist the chain between them. But our wrist is not a passive pivot point like this chain, it is active, our forearm does not snap the racket. [Nunchuks on the right from nunchaku.org]



The red line "funnel" over Andy Roddick's serve illustrates this concept. The arm does not swing out wide away from the body but instead moves remarkably up and in -- to the ball. The racket does swing away from the body out of the backscratch and the forearm follows close by, but the earlier mention of pulling the racket up butt cap first to the ball forms the basis for this execution. Andy's focus is to get the racket up to the ball and his "wide" backswing narrows down when it goes up, going from a wide profile to a narrow one as if there were an inverted funnel above him. His arm rises quickly and close to the body (if you look at it from above), the arm muscles propel the racket up and the wrist, held loosely throughout but gearing up for its explosion now snaps the racket up to the ball to send the ball over the net and down into the box.



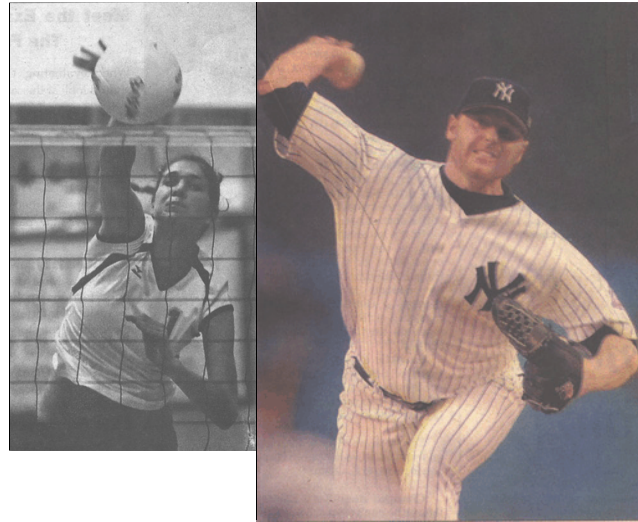
Whew. That's a lot of work just trying to explain it, let alone trying to do it.

## STAY TURNED 4 CONTACT

One of the biggest surprises is the idea of remaining turned during contact. The torso needs to fight to remain turned when you swing up to the ball instead of (giving in and) facing the opponent during delivery like baseball pitchers face the batter during their delivery. We fight to stay "turned" (in quotations mind you) longer than pitchers or volleyball players due to our game's reality, i.e. 27 inch stick in our hand for an overhead strike of a small rubber ball at over 100 miles per hour. Guys in biomechanics can explain this as related to body mass, restriction, acceleration, etc., boring, but to improve a primary objective is either to remain turned or not open up too easily.

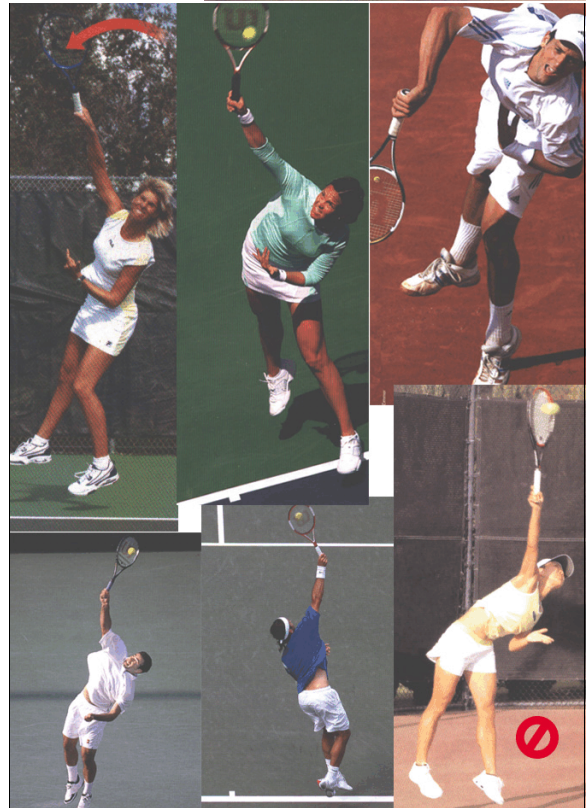


Roger Clemens on the far right faces the batter prior to and during release. His torso is square to home plate, after release his lower body reconciles, comes around, and joins in facing home plate.



The volleyball player spikes the ball, she faces the net although her front arm bends and looks like ours on a serve (for acceleration).

Tennis players, on the other hand, fight to remain turned. In the grouping of, left to right, top row, Brenda Schultz-McCarthy, Lindsay Davenport, Novak Djokovic, bottom row Sampras, Roger Federer, and an unidentified amateur in a health magazine, you can clearly see for yourself during impact no pro looks like either a baseball pitcher or volleyball player. The pros look scrunched like they do precisely because they are still "turned".



In direct contrast is the amateur lower right who has not only faced the net for contact (the back shoulder has come around a lot already) but is dramatically leaning over in her torso. Too often players look like this in their zeal to hit the shot out of the ball. Instead, if they were to trust in the incredible uPness of contact, they would be on the flight path to the Superior Serve.

Look at your torso like a rectangle, and during contact it is not facing the net but off to the side, facing the net post more or less. Yes your torso will quickly rotate around and face the net, right after contact basically, but the incredible uPness of contact is all about you remaining turned as best you can. Without the uP you won't get the smack on the ball you want, without the turned you won't get the uP.

How to do it? It's a byproduct of what has gone before. If your sternum goes up, if you keep the front half of your body up, and if you reach up in the swing it is more than likely - but not guaranteed - you will not open up prematurely.

You still have to fight to remain turned. And when you do you feel scrunched. And then don't just admire the Big One you dropped in there but get ready and keep the pressure on your opponent.

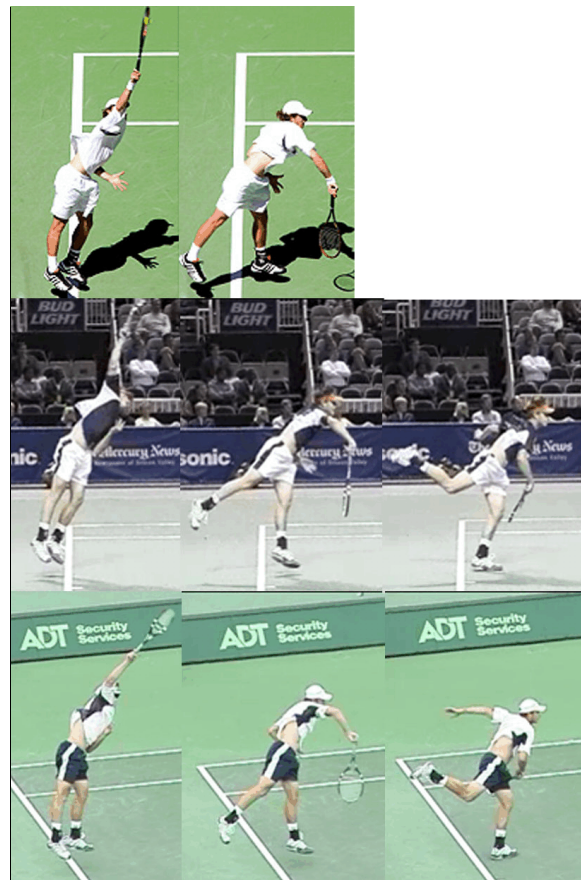


I illustrate remaining turned for the hit on the right. If I could stop in mid motion it would look like this, more or less, though I'm not flying through the air here. The idea is you are not yet open and facing the net. Too often at this point you are facing the net like the second photos in each sequence below.

A photo used for an earlier serve rebuttal notes the different look of Andy Murray and Andy Roddick during delivery, and now for this serve Step it is being used to distinguish how much each remains turned for contact, or not.

Murray, top row, obviously faces the net much more at contact than Roddick, bottom two rows. In fact his torso is square to it. Roddick looks more turned at contact and hits the bigger serve. It does not matter whether the toss in "out in front" like Murray is doing and you hit it flat, you need to fight to remain turned. One of the many distinctions of the Superior Serve.

The top guns have a little added stuff in their arsenal due to their superior flexibility and talent, and while you can see some tweaks here and there on film that perhaps aren't covered here these tweaks are organic to them and should not be grafted onto your serve. More on this in the last serve step following this one.



## SECRET

The simple secret to all this incredible uPness lies in your abs. When the racket's going behind you your abs contract and help you to get up, stay up, swing up, stay turned, and snap your wrist (upcoming). Too often players try to use the musculature of their arm, shoulder, back, or legs to help drive this stroke. But once we wire a pro's body with sensors I'm willing to bet the abdominal structure fires more than any other large muscle group on the serve. The hand and wrist, of course, will measure the largest spike, but for length of duration and load the abs will star.

What does this mean? Heck, those situps you're doing or not doing aren't just for looking sharp! Situps for serves! Hoo-yeah! Yoga for serves! Pilates for serves! Any core workout is for your serve! [And of course for all your other strokes, but it is of incredible importance on the serve because you don't get to move the body.]

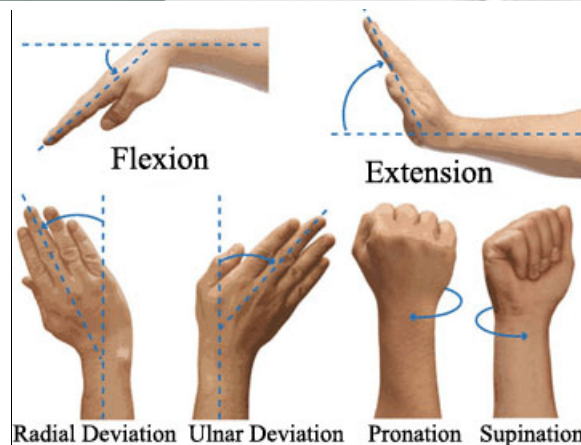
## PRONATION... OR WRIST SNAP?

Pronation describes rotating both arm and hand outward when throwing a ball. On a tennis serve at the last minute the hand and forearm rotate open, or pronate, to present the strings to the ball, if not you'd frame it since the racket comes up on its edge since you're using a continental grip.

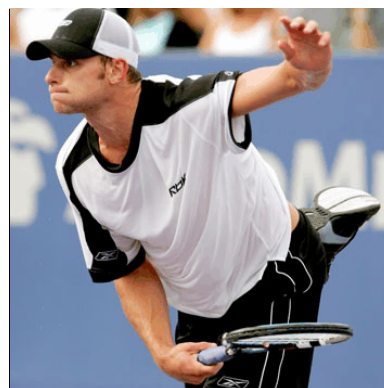
But what does the wrist do? Pros talk wrist snap, scientists/observationists say no such thing occurs. Scientists like to opine, "often what they [pros] say is not what they do." Are the pros wrong?

Film evidence at 250 frames per second shows the hand pronating right after contact, the racket and hand turn very much outward as if hitting an inside-out screwball (similar to photo Roddick near right). And evidence also shows the racket face and hand not turning very much outward but remain facing forward to the opponent (similar to photo Roddick far right).

But the hand doesn't either follow through or remain with this extreme pronation, the ball does not sail inside-out wide pronation *seems* to suggest. The racket face turns toward the server's body, the wrist quite obviously bends (i.e., flexion + ulnar deviation) and the hand turns in as seen in the Sampras, Agassi, Roddick photos.



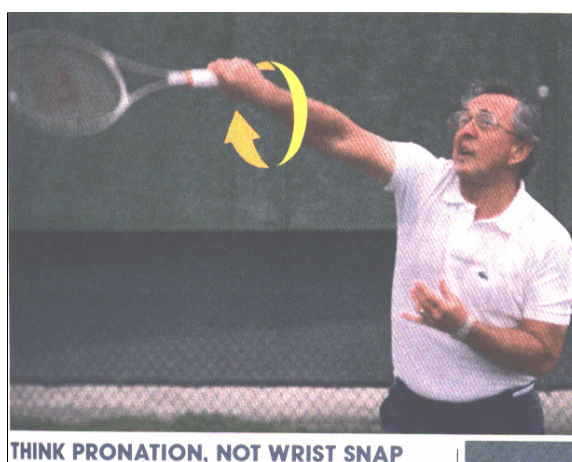




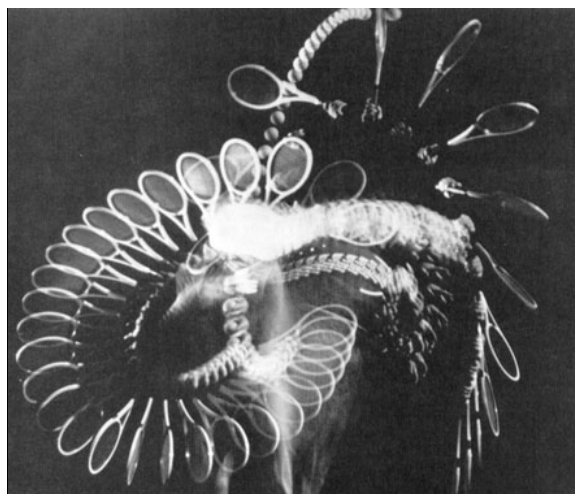
The hand does not bend simply at the wrist. Question becomes for the student:

### DO I SNAP MY WRIST OR ONLY PRONATE?

Many self styled tennis scientists look at the film evidence and say, "Aha! The key is to pronate the forearm and hand/wrist!" But the loudest voice out there says you do not snap your wrist. In fact, Vic Braden says his "studies show there is no wrist snap on the serve; anatomically it just does not happen.... In high speed photography, the only time we find the wrist bends during the serve is in the middle of the loop, not at impact... [because] the hand is absolutely out straight; there is no displacement of the wrist at impact." Vic doesn't offer this as a curious fact but to support his claim a wrist snap is "a myth."



On the right is Vic captioned illustrating "think pronation, not wrist snap" [TENNIS magazine, August, 1989, photo by Dom Furore], below that is Vic's serve swing in strobe-like effect (from his 1977 book Tennis For The Future) that shows the pronation turn-out of the racket just after contact for two images before it turns back in (due to a wrist bend, but more later).

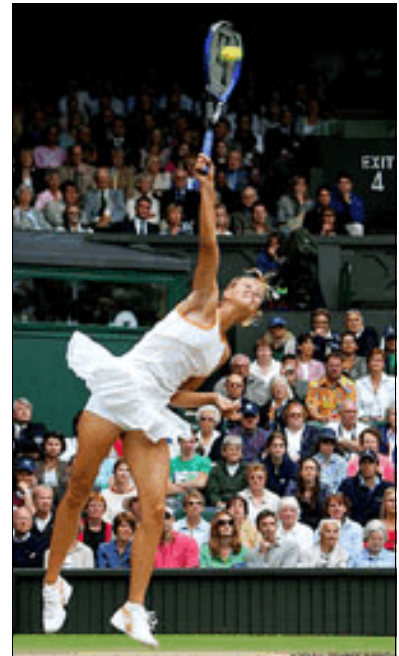


What Vic and others say is high speed photos (**Revolutionary Tennis** has seen some) show that at impact, and right after, the wrist does not continue moving or bending forward (flexion) but instead pronates, or turns out. The same can be said of a baseball pitch and yet "snap the wrist" is part of their instruction.



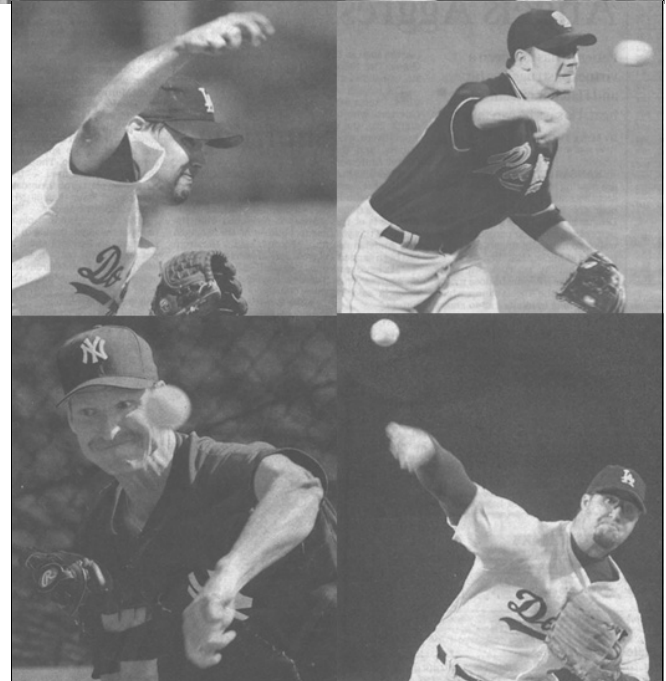
The group above shows the wrist laying back before swinging up. Sharapova, right, shows the wrist straight at contact. Vic says, "the wrist bends in the middle of the loop, not at impact," which means the laid-back wrist moves, or bends, up and forward to the contact position to be, as Vic adds, "absolutely out straight, there is no displacement of the wrist at impact."

A series of Curt Shilling pitches below shows the different stages of the wrist during delivery, from bent to "absolutely out straight" at release. At release it looks like it does not bend over forward.



More looks of a pitcher's hand at release and soon thereafter. In the baseball foursome group, Aaron Sele, top left, the wrist seems to be bending forward; pronation is seen in various degrees with Jake Peavy, top right, Eric Gagne. bottom right, Randy Johnson, bottom left. Point is in baseball, regardless of the look, it's called a wrist snap.

The pitchers' hands turn like ours do. Peavy's arm, top right, looks like Sampras's 3<sup>rd</sup> one in his group previous page.

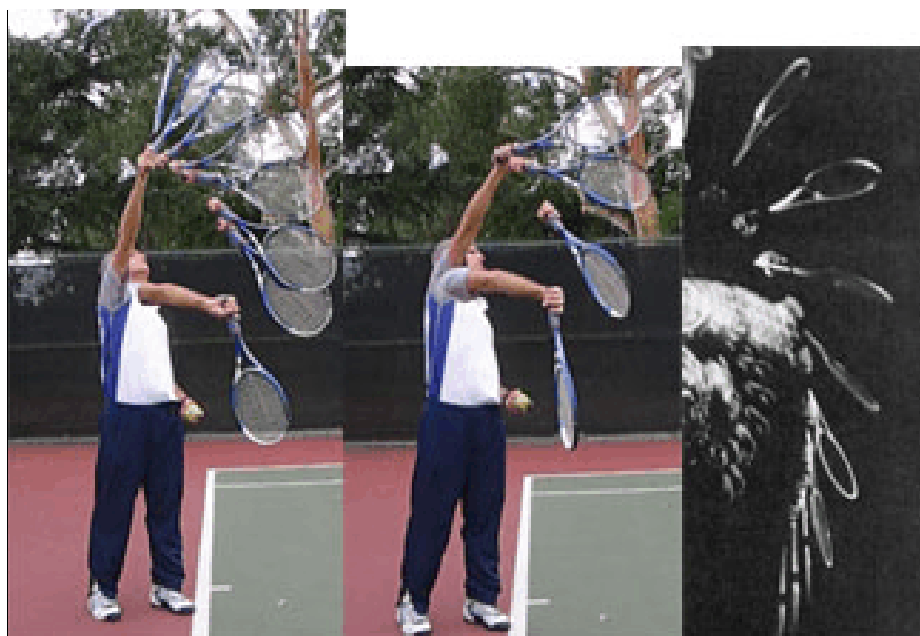


Why the confusion? To the tennis scientist guys "wrist snap" means the wrist snaps/breaks forward like we see on the follow through when shooting a basketball. You know a tennis pro's wrist does not flop over like shooting a basketball on a serve, and neither does a baseball pitcher's, so where are these guys coming from? They are merely trying to interpret and inform what they see on high speed film, and scientists have the tendency to assume what they can see is all there is *to see*.



If you to snap your wrist with a continental grip you don't look like #23. Scientists complain pros are often wrong in what happens during a swing, pros complain scientists can't do what they're seeing so how can they know what's happening? Any flexion at contact used to counter the opposite force, even when mild, is that a wrist snap? A wrist bend? If we say the earth is round, who's gonna tell us it's really an oblate spheroid? Basically round then? Round-ish? The horse is out of the barn.

Offering pronation or a loose wrist does not explain *all* the look and appearance of the pro's wrist, too many questions remain. The series below shows what the racket and hand look like first turning outward with a stiff hand/wrist for pronation only (left photo), and then loosening my hand/wrist for pronation with wrist flexion + deviation (middle). Though I am not hitting a ball, the first photo, pronation-only, does show a little deviation. The middle photo adds the wrist flexion + deviation during the swing and not just after the imaginary contact. The racket turns back in, it does not remain facing out to the side. Vic's black and white photo, far right, resembles the middle photo because of the presence of wrist flexion + deviation during his swing even though he categorically denies it by claiming it happens after contact either voluntarily or not.





You get this characteristic look of the racket and hand turning back inward sooner or later in a pro's serve. Next question becomes: Is the wrist displacement seen after contact due to the arm swinging around, a relaxed wrist, a "release of natural forces," or is it because the pro is doing something with the wrist prior to contact?

### IT DOES NOT ADD UP

If tennis scientists don't see the wrist bending forward during impact on high speed film is this "proof" it is not? Absolutely not. But what do they see? They see the racket moving up to the ball and then left to right across the ball, they see the contact inside the hand and the racket travel not backwards but forward and to the side, they see the hand turn out and then turn in and move down and across the body.

Photo far right the #11 on the fence shows the ball is inside the hand during contact. The racket slides across the plane of the fence to show the left-to-right movement across the ball *everyone* acknowledges even though of course the ball is not hit off to the side.



A singular forward-only movement of the wrist would mean the tennis ball is struck along one direction straight head-on like holding a gun and firing a bullet down into the service box. This does not happen since we know we hit up on the ball. We also know we hit across the ball, but since the ball does not go off to the side of the service box something must be turning the ball around the other way *to* the service box. It is time for the clipboard set to acknowledge what they're seeing on high speed film of a tennis player's wrist is not all there is to see and that how they interpret it begs for greater depth.

### WRIST MOVEMENTS IN 3-D

A tennis pro's wrist first bends uP to hit the ball uP over the net, never eye-level forward. Secondly our wrist goes across the ball (west-east) since the contact is inside the hand. Thirdly since the ball goes to the service box on the other side of the net and down this means forward projection along with hitting off center for spin. Up. Across. Over. This is our snap, and the wrist works in three movements, or planes. Ours is an uPward flexing motion done in conjunction with ulnar deviation to ultimately send the ball down into the box off to our side.

Put these three movements in motion and what comes out looks like the photos and high speed video we see. Funny thing is the guys in the white coats agree to these movements. But they don't call it a snap.

Priorities for a first serve:

|                 |           |        |
|-----------------|-----------|--------|
| 1 <sup>st</sup> | Movement: | Up     |
| 2 <sup>nd</sup> | Movement: | Over   |
| 3 <sup>rd</sup> | Movement: | Across |

For a second serve:

|                 |           |        |
|-----------------|-----------|--------|
| 1 <sup>st</sup> | Movement: | Up     |
| 2 <sup>nd</sup> | Movement: | Across |
| 3 <sup>rd</sup> | Movement: | Over   |

Tennis scientists correctly point out two things: 1. A wrist snap (for them a forward wrist snap), is not responsible for power, and 2., because of #1, priority must be placed on the proper stroke mechanics preceding contact (a pronating arm) to produce the power you want.

Tennis scientists (and most teachers) also correctly point out that failing to pronate the arm leads to a crappy serve. Failing to pronate the arm means the hand is laying back in the dreaded waiter's tray position. There are plenty of 4.0 players and above who toss the ball and lay the hand back right away only to proceed and snap their wrist just like a basketball player. Of course this works to some degree, but the player will always lack the Superior Serve.

It seems to **Revolutionary Tennis** that instead of yelling "the sky is falling" to emphasize pronation over wrist snap scientists should emphasize avoiding the dreaded waiter tray position, the very ingredient that leads to the lack of pronation to begin with. Then you can pronate more comfortably and, omigod, you can do the wrist movements! Yes!

### **WRIST MOVEMENTS: ACTIVE OR PASSIVE?**

The next tennis can the scientists kick around is whether a pro actuates the wrist movements or whether the wrist bends forward because the arm is pronating. In other words is the wrist active or passive. They claim the wrist "is along for the ride," pros say otherwise.

While it is possible to both throw a baseball and shoot a basketball without any voluntary wrist movement we all know the quality of the outcome. A stiff wrist makes for a lousy foul shot, ask the Big Aristotle.

If the wrist were along for the ride on a serve and the forearm hit a wall the wrist would break forward like a crash test dummy flying through the windshield in a head on collision if not wearing a safety belt. But this is not the case, the racket face impacts a ball. And if indeed the wrist were along for the ride we'd see at contact on high speed film either the racket face bouncing back or the wrist laying back. Instead, both racket face and wrist/hand move forward because there is strength/resistance at the wrist joint.

How else to explain a pitch, a jumper, a tennis serve but to say the wrist is doing something on purpose? No? Because we can't see it on high speed film? This is not the technology required to document it. Again, lack of evidence can not be used to disprove.

A wrist action in three movements, or planes, designed to send the ball in a particular manner to a particular spot. Sounds like an active wrist to me. And speaking from experience, it's nuclear.

## NUKE IT

The lead horse in the serve stroke, like all others, is the hand, but here the wrist movements are nothing short of nuclear. **Nuclear!** You can say you need "snap" the hell out of the wrist, or "snap" it like there's no tomorrow, but it doesn't do justice to the event. The wrist "snap" on the serve is the single, most explosive event in the game. It is awesome, it is ab-so-lutely nuclear in a pro's serve. It's like you're willing to lose your wrist it's so dramatic, it feels as if your wrist is going to fly off from the rest of you.

To achieve this the wrist remains **unaffected** by the arm's down and up motion, it lies dormant and wholly **independent** while the hand maneuvers the racket, both arms move, the body bows. The wrist acts **loosely** as if on a gyroscope even as the fingers progressively tighten on the handle, and is ready to leap into action like a camouflaged tree snake pouncing on its prey. It stirs to life as the racket sways down fully into the backscratch position, it remains sideways like a karate chop as the hand pulls the racket up and then, at the last moment, boosted best by arm pronation and shoulder rotation, it literally snaps itself silly. It gives everything it has, it performs completely, and it either succeeds or not in delivering the ball as intended.

The preceding paragraph explains "the wrist is along for the ride" idea offered by scientists. A loose wrist is by definition free and independent, but at the last minute it **explodes**. Purposely.

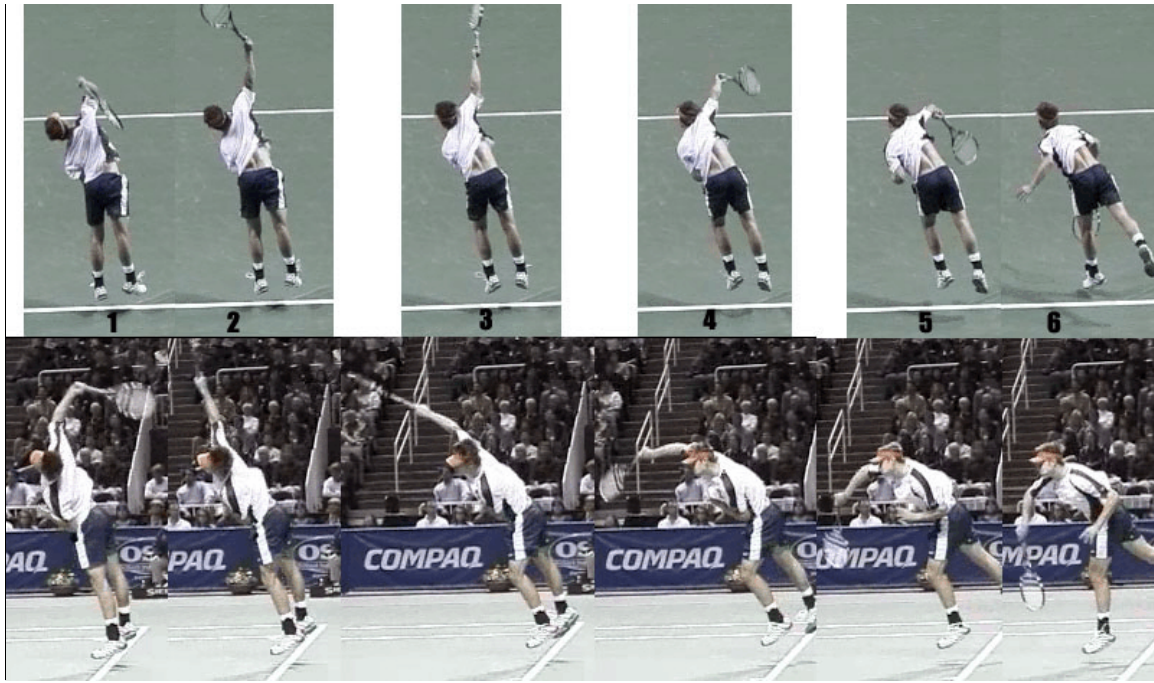
You don't think about using the wrist until the last minute, when it's needed, if you think about it earlier during the swing you wind up shortchanging the swing mechanics needed for success. You have got to hit the other points in the Superior Serve first to be able to go nuclear with the wrist. With this understanding you can see tennis scientists' observations are correct in their own way - don't omit pronation for the snap, a loosely held wrist, a wrist along for the ride - but they just can't *prove* how the wrist fits in. So they call it passive. Perhaps if they understood the event better they would be better able to prove it.

## MORE RR-UBBISH

Pronationists like to point out there is "more" pronation on second serves than on first serves, that is on film they see a more pronounced turn-out and conclude on second serves you pronate more! So while you can *actually* bomb a ball in turning the hand inside-out on purpose, how do you do topspin, slice, or more spin? By turning the hand inside-out more on a second serve, as in "unscrewing a light bulb," "endorotation," "extending the elbow"? Quixotic, to say the least.

The pronation effect is less seen on a strong first serve because the wrist acts more forward than across and is stronger. There is a much more forward angle and direction to the wrist on a first serve and as a result the racket may not twist as much, i.e. the hand is not so overwhelmed by the arm's pronation strength (more below).

On second serves the angle of the wrist's attack is less forward and more upward and across, and contact favors more off-center-of-ball spin and can be higher on the ball. A pro's wrist now works more pronouncedly for spin as opposed to driving through the ball as on a first serve. The hand is now easily overwhelmed by the arm's pronation-rotation momentum and turns out easily post contact. On a second serve the arm accelerates just like on the first, and maybe even more (across the ball).



It's ludicrous to think you "pronate more" on a wide slice serve than on a hard flat first serve up the middle. When I "brush the outside of the ball" for wide slices I am not inverting, or pronating, more, I curl the wrist more than if I bomb a first serve (a tennis serve curl, not a dumbbell curl). Roddick's photos above, both serving into the deuce court, match up pretty well even though the bottom set is a little more ahead in time (#2 top is pre contact, #2 bottom is at or post contact). In the series you clearly see #1 the racket on edge, #2 it opens, #3 it has hit the ball and is turning out, #4 it turns out fully, #5 it turns inward, #6 it turns in fully. Of note is #3, and bear in mind the bottom row is ahead of the top row in contact time. #3 top we see the racket turning outward but in #3 bottom the racket appears sideways from our side perspective, it has not turned outward yet. I'm willing to bet the bottom #3 is a first serve for reasons explained in the paragraphs above.

Perhaps it's best to leave it to the PhDs in biomechanics to confirm the curious effect why pronation looks like it does on a tennis serve, as long as they heed what pros say we are doing instead of dismissing us. Not absolutely everything we say can be wrong, right? This way we can have a dialogue and indeed move tennis into the future.

### WHY THE RACKET TURNS OUT

The racket turns out on contacts more often than not and tennis players offer the equal-and-opposite effect of contact masks, stops, or inhibits the wrist from bending forward. But the guys in the white coats say that shouldn't be the case. And while more than likely correct, something indeed is, and it's both voluntary and involuntary.

Why does the hand turn out then? It happens on weak serves, and it happens in baseball where there is no equal-and-opposite contact force at work against the hand. The hand turns out because the pronating arm is stronger and pulls the weaker hand along with it.

The pronation-rotation of the arm works on a different plane, or angle, than any wrist movement (flexion, deviation, extension), and their agendas and strength values are different. The superior



strength, or force, of the entire arm pronating (inward) overtakes the wrist's up/over/across movements and pulls it into its (contrary) plane of movement. The wrist is easily overwhelmed and follows the inward turning arm, thumb down. The hand turns out away from the box but soon turns in again to show us what it was doing.

That was involuntary. The voluntary act that leads to the turn-out is spin. In order to prevent the ball from flying long the racket comes off the ball, making the hand weaker and more susceptible to the inward pull of the pronating arm.



This basketball shooting sequence shows the "wrist snap" happens long after the ball has left the player's hand and yet basketball biomechanists instruct "wrist snap." It is easy to imagine and see in basketball and baseball, but then why do tennis biomechanists deny a "wrist snap" in a tennis serve? Because the speed at which it happens blinds them, and the tennis racket in the hand obfuscates it. Assuming what one can see is all there is to see is not scientific.

## NOW FOR SEMANTICS

The wrist bends forward (flexion), bends backward (extension), and to the sides (deviation). Deviation adds degrees and dimension to wrist movement. You loosen the wrist to move it and if you move it quickly or sharply it's a snap. The three wrist movements explained above are in fact a wrist "snap" since they are done with emphasis and energy, and it climaxes the Superior Serve.

The real question is whether "snap" is intransitive (a brisk, sharp movement in the wrist), or transitive (is the racket projected with a snap of the wrist). Which brings us back to: is the wrist passive or active? Tony Trabert (many times), Tim Gullikson (10/91), even Peter Burwash (9/01) all use the term "snap the wrist" in TENNIS magazine when describing a pro's serve or how you can serve better. Something obviously is missing in the translation. Either it really is a wrist snap for a tennis player's serve, or it's not. Either the wrist is active, or it's not. There is no gray area.

Theories that work in science are called "elegant" because their single, simple solution explains problems both large and small. When someone's hypothesis goes on and on, saying in effect, "it couldn't be this simple, it's really more complex and involves all these extra systems..." then perhaps a red flag should go up. Gray areas in science have often been pushed to hold off an alternative point of view because it either threatened the establishment, the status quo, or someone's job. The examples are far too numerous to list, from astronomy, physics, life sciences, genetics, virtually every field. And in each case a single truth emerged that displaced large amounts of explanation.



It is no different in our itty bitty corner of existence. "Snap the wrist" is such a simple proposition and yet the logorrhea used to discredit it is staggering.

### **IN DEFENSE OF BRADEN, ET. AL.**

I have been informed there are well known coaches and club teachers who advocate a forward breaking motion of the wrist on the serve and who focus on the snap at the expense of the mechanics. Future science may indeed quantify there is more forward wrist flexion than either upward or across, but for now to advocate *only* a forward breaking of the wrist instead of putting it in context with the other two directions is limiting, and the coach who focuses on that aspect exclusively is being a blockhead.

Vic Braden and the other well intentioned men and women out there who emphasize pronation and say don't snap the wrist do so, I believe, to refute those blockheads. This is a good thing. In this way Vic, et. al., are imploring you to remember the mechanics of the hitting arm, and are correct in pointing out it *seems* we don't snap so much forward like on a basketball shot.

But it also disrespects regular players, and can be confusing to say the least.

Those in the tennis teaching community who debate these things underestimate the intelligence of tennis players. Saying something is not happening and offering an explanation that doesn't seem to *elegantly* cover all the bases tells tennis players the teaching community either doesn't respect them, isn't up to speed, or has its own problems.

Scientists should tell the whole story and ignore the blockheads, they should share their information even if it contradicts an earlier point of view. Good scientists are flexible, open minded, and forward looking because their discipline demands it. Bad ones cling to the past.

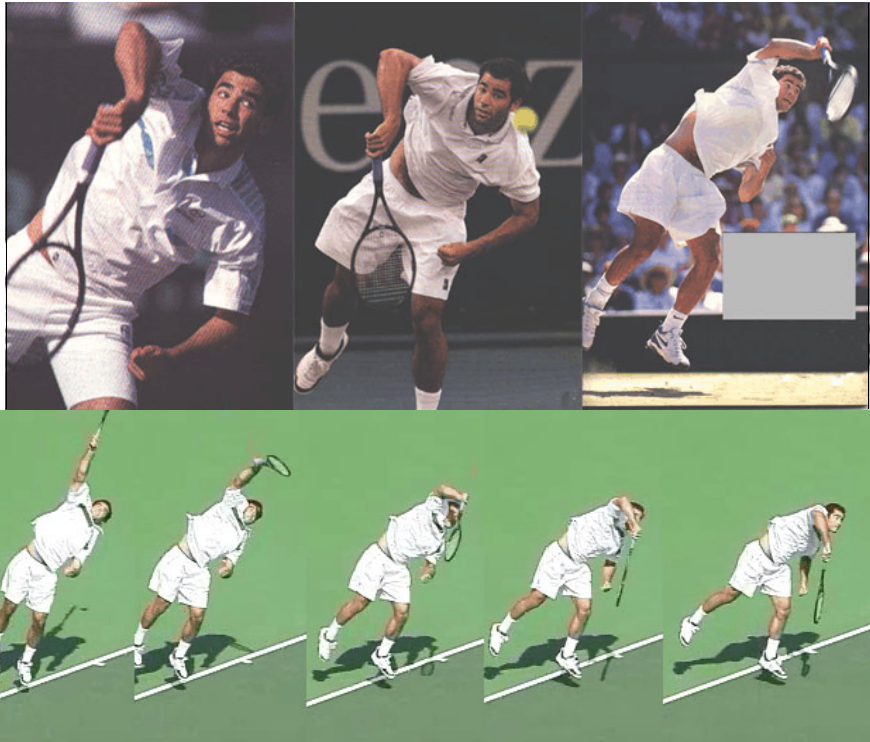
Athletes often are too egotistical and inflexible in helping discover what really goes on with their execution ("I was taught this way, I have always done it this way, this is how I do it"). Good athletes can put their stubbornness and self centeredness on pause for self improvement. Bad ones think they know it all.

No pro's hand has been wired with a sophisticated enough instrument to prove or disprove wrist usage, which renders the whole debate on this topic moot. When that time comes we may see more than meets today's imagination, and perhaps the ideas offered here will be repudiated. Until that time, and hopefully sooner rather than later.

## PRETZEL

The arm's signature on a Superior Serve after contact takes on a pretzel look, confirmation of the nuclear wrist snap and the incredible uPness of the swing pattern while also getting the ball down into the service box less than 60 feet away. You can not build up to this point and expect the arm to look like this, it is brought to you only by the nuclear wrist snap. It's do or die.

Photos of Sampras show this effect. The arm looks like this for millisecond(s), you do not hit the ball and stop the arm to look like this. The arm is "straight" on contact but since the biceps muscle slows down to help accelerate the forearm, hand, and ultimately the racket via a nuclear wrist snap the whole scenario becomes top heavy and the arm pretzels as a result.



Another image that works is the racket acts like a pole vaulter going up and over the bar. The racket face turns up and goes up (the vaulter turns feet up to go up), the racket pivots at the handle as if it had to clear the bar and turns down dramatically much like the pole vaulter. In other words the racket arm does not look like a javelin thrower's arm because the racket is not being thrown for as much distance as possible. [pole vault pictures by: Hunter Peress]



In pitching a baseball you can also get this pretzel effect, but I suspect ours is more pronounced because we snap the wrist more while also holding a long stick in our hand and striking overhead to bring a ball down.

The only way to achieve this is to grow into it. There is a wrist snap drill that can help lead the way for you and from which you learn how to first discipline the wrist. Snapping the wrist is the foremost element to this pretzel, not bending the arm or using the arm. When performed during a most celebrated swing uP to the ball you will start to get the pretzel effect. Of course it only lasts

for millisecond(s) so don't go looking for it. The way you can see if you achieved it is in the quality of the serve, by an effortless feel and good hop to the bounce.

On a popular site they advocate achieving this pretzel look by "keeping the elbow up and racket down." Are you supposed to stop the arm on a serve to keep the elbow up after a nuclear snap? I've tried asking students to hold the arm in a particular position but that doesn't work, they slow down the stroke to satisfy a look and in exchange don't get the snap. When I emphasize the snap the pretzel look happens, but of course only when the snap is first class. Think snap first and then the elbow-up-and-racket-down will happen. If you don't get it don't worry, worry instead of snapping the wrist as much and as best as you can.

It is not surprising that top guns started playing tennis when only one number was associated with their age. When we learn as youngsters we tend to go overboard, we experiment a lot and often get into trouble, unlike learning as adults. I would practice nailing the wind screens, nailing the fence, putting the ball through the fence, seeing over how many courts I could hit the ball. I'd also serve balls after moving automobiles to see if my ball could catch up with them - what a tennis bum!

Point is if you want to really, really improve your serve you're going to have to go this route. No, not hitting tennis balls after moving cars or slamming them into wind screens, but serving thousands of balls yes. There's no way around it. Sorry.

## **SECOND SERVE**

The best way to hit a second serve is to whack it, you have just got to hit **at** the ball hard. Words used are "hack at it," "cut it," "curl the wrist." This way your hand gets used to taking the tennis ball's head off. [Didn't know the ball had a head, did you? Sort of.]

A first serve is hit more forward than a second serve and "flatter," i.e. less ball rotation. A second serve has more rotation, or revolutions, on it. To hit a second serve with some pace and with more rotation than a first serve but not as forward you need more racket acceleration. I don't know if this has been confirmed yet in a realistic experiment, but there is something "more" going on with second serves than with first. If I am not right with more acceleration then there's more wrist and hand work going on when going for a second serve. Maybe it's more wrist deviation.

But more on a second serve. Have some balls, señoras, señoritas, y señores. Y más of'em on a second serve.

## **SPIN**

Spin is well covered on virtually every tennis site, i.e. the way the racket moves across the ball, up the ball, over the ball, around the ball. But two items need more explaining.

First, bear in mind on a serve the ball is tossed up in the air and it descends as the racket ascends. In other words we have a traditional low-to-high model here like on groundstrokes, the racket travels from below the ball to above it for topspin or most spins. The tennis racket face turns up, like the pole vaulter turns his feet up, as the ball is coming down, the racket face rises up against the ball that drops. The two scenarios merge and synergize to produce spin.

You can get spin without a descending ball but you'll get more spin with a ball that descends. Which means the more it drops in height before you hit it the more spin you can achieve (with the right grip and wrist action). But of course within reason, don't toss the ball as high as the light standard.

Second, make the racket face travel over the ball and toward the service box, don't just cut at the ball and finish your stroke. There is intent, and reason, to that second serve. You're going to make the ball dive down into the box (instead of bombing it as a first serve), you're sending it into a particular area of the box, and specifically you're making the ball hop one way or the other. It's all done on purpose and can only be realized when you send the ball **over on a path line** instead of popping it up/spinning it up and watching it come down.

Too many players just spin the ball well on second serves but fail to project it (down and in) to the box like they do on a first serve. The secret to the heavy second serve is, again, *¡cojones!*

### A SERVE IS ALWAYS A SERVE

Of course you can improve your serve without hitting it at 100 miles per hour or having a nuclear wrist snap. But for all serves:

There's only one way to hit a serve. And that's to hit it. At 100 miles per hour, 100 kilometers per hour, 100 feet per second, or 100 centimeters per second. Nail the damn ball every single time. This isn't a groundstroke. Hit It. And nail the second serve too.

There will be no doubt. No Hail Mary's. You can't offer your first-born or make a pact with the devil for a good serve. Hope does not exist. There is only execution. Yours. Execute with certainty. If you miss you will hold your head high and execute better next time. Which means the very next serve.

You are told ridiculous things about the serve. As in swing up like throwing darts in the ceiling or unscrewing a lightbulb; kick your back leg back during the serve on purpose to...help accelerate the racket; keep the toss arm down and in to constrict the racket arm; swing like you're twirling wine out of the glass; double pump with the arm or use a dual leg drive; wear your hat backwards... These all sound like coming from a snake oil salesman trying to sell you something. Trust your instincts.

The serve is a stroke even pros don't master. While all playing pros have good serves, a lot of them work too hard for their result and others can't claim theirs to be a weapon. A Superior Serve looks graceful, smooth (Roddick notwithstanding), and can be a weapon. Few achieve this yet all aspire to it.

I don't know why Sampras, Federer, Ivanisevic, Shultz-McCarthy, Davenport serve so well, what possesses them to nail it like they do and wind up to it like they do. It's a blessing, certainly. Athleticism of course is part of it, playing other sports is a part of it, having influential teachers and professional idols is a part of it. Growing up watching pros up close and personal is a part of it. Of course it doesn't hurt to possess a flexible, quick, and pliable body, a courageous or cold heart, and a relaxed, focused, mind. And then there's that extra something inside...

But you don't need a Superior Serve to have a good serve. What you need is a serve both worthy

of, and worth, your effort. A steady serve is a good serve. A good second serve means you have a good serve. A well placed serve means it's a good serve. A serve that does not allow your opponent to return it back down your throat is a good serve.

Think holistically with the serve. If you want to improve your serve you need to budget the time, find the application, and follow the "wax on, wax off" philosophy to improvement. If you don't know that philosophy go rent the movie The Karate Kid part 1. Old school is the way to improve, there's nothing new under the sun here.

There you have it. On this page are the major components missing from what you undoubtedly have read elsewhere. In my humble opinion they are more responsible for serving success than elbow and triceps up, endorotation of the arm, leg drive, because they provide the platforms, successively, that support each of those individual components. Quite a lot of "how to serve" is taken care of when the larger components hit their marks. As an example, working on accelerating the arm at the expense of working to lift and position and hold the body up to provide the moving arm the strongest platform to jump off from just won't do it.

Btw, the word "up" regarding the stroke is mentioned almost 100 times.

**Photo credits: STERNUM:** Sampras: from uncredited film tennison.com; Courier: from uncredited film tennison.com; Roddick: from uncredited film tennison.com; Henman: TENNIS Magazine, September 1997, Stephen Szurlej; Ivanisevic: TENNIS Magazine, September 1996, photo by Stephen Szurlej/TENNIS Magazine; Weaver: LA Times, 12/3/06, Jae C. Hong; Rios / Ivanisevic comparison: USTA High-Performance Coaching, Vol. 4, No.1/2002; Phillipousis: TENNIS Magazine, December, 1996, Stephen Szurlej; **FRONT HALF:** Sampras montage: from uncredited film tennison.com; Sampras outline: USTA High-Performance Coaching, Vol. 7, No. 1/2005; Rosset outline: TENNIS Magazine, December 1994, Stephen Szurlej; **FUNNEL:** Roddick: from uncredited film tennison.com; **STAY TURNED:** Volleyball player: LA Times, 12/2/06, Alex Gallardo; Clemens pitch: LA Times, 6/14/03, Associated Press; Montage: Schultz-McCarthy: TENNIS Magazine, March 2005, Manuela Davies, ProPix; Davenport: GETTY IMAGES, USTA supplement, TENNIS magazine, July/August, 2006; Djokovic: TENNIS WEEK, July 2006, Paul Zimmer; Sampras: USTA High-Performance Coaching, Vol. 7, No. 1/2005; Federer: USTA High-Performance Coaching, Vol. 7, No. 1/2005; Amateur girl: Southern California Tennis & Golf magazine, May / June 2005; Murray: TENNIS Magazine, October 2006, Tommy Hindley / Professional Sport; Roddick serve compare: from uncredited film tennison.com **PRONATION:** Roddick b&w: Inside Tennis, 07/05, Getty Images; Graff: TENNIS Magazine, 05/97, Stephen Szurlej/TENNIS Magazine; Sharapova: uncredited from web site; Roddick finish: Matthew Stockman, GETTY IMAGES; Roddick serve color: uncredited tennison.com film; Sampras 1: TENNIS Magazine, September 1999, Gary M. Prior, ALLSPORT; Sampras 2: TENNIS Magazine, September 1994, Caryn Levy; Sampras 3: TENNIS Magazine, January 1994, Ad; Agassi wrist snap: LA Times, 09/06/05, Shaun Best, Reuters; Layback Montage: Rusedski: USTA high performance newsletter, Vol. 4, No. 1/2002; Federer USTA High-Performance Coaching, Vol. 7, No. 1/2005; Sampras: from uncredited tennison.com film; Martin: TENNIS Magazine, March, 1996, Stephen Szurlej/TENNIS Magazine; Baseball photos: Curt Shilling 1: LA Times, 8.11.01, Agency France-Presse; 2: LA Times, 6.07.01, Associated Press; 3: LA Times, 4.08.02, Reuters; 4: LA Times, 8.17.02, Associated Press; 5: LA Times, 6.09.02, Associated Press; Aaron Sele: LA Times, 3.12.06, Allen J. Schaben, LA Times; Jake Peavy: LA Times, 9.19.06, Gina Ferazzi, LA Times; Eric Gagne: LA Times, 6.22.02, Wally Skalij, LA Times; Randy Johnson: LA Times, 3.07.05, Tony Gutierrez Associated Press; **ADD UP:** Roddick, TENNIS Magazine, summer 2006, Mike Hewitt/Getty Images; **PRETZEL:** Sampras 1: TENNIS magazine, January 1994, Ad; Sampras 2: TENNIS magazine, May 2000, Vincent Laforet, ALLSPORT; Sampras 3: TENNIS magazine, September 1994, Caryn Levy; Sampras pretzel sequence: from uncredited film tennison.com.



# Revolutionary Tennis

## Tennis Instruction That Makes Sense

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### GRACEFULNESS SERVE DRILL

© Mark Papas  
mark@revolutionarytennis.com

Some pros look more graceful than others, though all professionals look pretty damn good. Is it due to years of practice, genetics, athleticism? Who knows, but let me share what I learned that may have helped along the way.

**Gracefulness how-to.** Like dancers, this is performed in front of a mirror so you get feedback in order to reinforce the body movement required.

**Objective:** to reinforce weight shift for the bow and toss arm lift; to eliminate your self-consciousness; to familiarize yourself with how your body's working; to recognize the rhythm, speed, timing, and spacing of these elements.

**Method:** no racket needed. Stand in front of a mirror and while looking directly at the mirror begin to move your waistline to reflect the archer's bow while dropping the arms together and raising them together for their different objectives. The toss arm is as straight up as it can be, the racket arm up half way and bent, the hand up to simulate holding a racket. **Look at yourself** in the mirror to reinforce the bowing of the body, the upward arm, the bent front leg, the body weight down. Return to a starting position and repeat, many times. Practice as often as possible, forever.



The special tip to add here is dancers wear either very tight clothing or clothing that reveals more than it conceals in order to get the feedback they want from the mirror and their body. Tennis players need to practice their serve motion's gracefulness in exactly the same manner dancers practice their moves. The idea is to both explode your self-consciousness and notice how the individual parts of your body move (groin, hips, toss arm), when each moves, and by how much during the weight shift and bow. Once imprinted the speed and sequence to how the groin moves, the hip sways, and the arms lift can you transfer this when on the court and think only about hitting the ball.

# Revolutionary Tennis

## Tennis Instruction That Makes Sense

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Serve:

### BALL TOSS DRILL

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mark@revolutionarytennis.com

I learned this simple toss drill from the late Mr. François Savy, head pro when I first knew him at the Altamira Tennis Club in Caracas, Venezuela, and later at the Tamanaco Intercontinental Hotel in Caracas where now his daughter Françoise holds court.

The toss arm needs to be smooth and not herky-jerky, yet lift completely and continue moving smoothly after releasing the ball. Mr. Savy had me fill a triangular paper cup you find at a water cooler two-thirds full of water and hold it in my toss hand as if I were to take a drink. With the racket in my other hand I would practice the down together, up together motion while shifting my body weight, and the idea was not to spill any water out of the cup. Of course the water would jump out of the cup as I raised it, and later I learned to **smoothen** my upward lift and how to keep the arm straight without spilling. You can do this drill holding any small cup in any manner. [My cup is half filled here, and luckily water didn't spill. Goes to show you muscles and tendons do "remember."]

A second toss drill, common to every pro, is to place a racket on the court next to the toe of your



front foot. The handle touches your toe and the strings point out almost perpendicularly to the net, slightly off to the side. This one you practice with a racket in your hands, and when you practice "down together, up together" and release the ball you hope the ball lands on the strings of the racket in front of your foot.

The very first toss drill for anyone is to simply lift the tennis ball out of your hand and, keeping the arm up and extended straight, you catch the ball. Keeping the arm up and straight.

You can practice lifting the cup of water or tossing the ball out of your hand while at work, seated or standing, telling interested parties if your boss practices his/her putting in the office you don't see why you shouldn't be able to practice your service toss. I'll back you up.

# Revolutionary Tennis

## Tennis Instruction That Makes Sense

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### Serve: RACKET ACCELERATION DRILL

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You can increase your serve's power by isolating and practicing the forward acceleration part of the serve. The arms moving down and up, the body bowing and twisting offer rhythm and set-up for the acceleration area of the stroke. More rhythm and a better set-up can lead to more acceleration if the rhythm is simple and the set-up lacking exaggeration. The acceleration part of the stroke occurs from the back-scratch position upward, the entire stroke builds to this moment. Yes, the racket is never stationary in that position, it drops down and then immediately goes up, the arm working like a spring, but it is the upswing where acceleration occurs.

**Objective:** increase acceleration.

**Goal:** hit the opposite fence on the fly from the baseline starting only from the back-scratch position and without taking a step or rotating much, if at all.

**Method:** open your stance, bring the back foot around to simulate an open forehand groundstroke (protecting your shoulder since you will not be shifting body weight to assist), and place the racket behind you and down the back (the back-scratch position). Relax the wrist and arm. Toss the ball on the lower side and outside a bit, no need for a "perfect" toss here. Swing aggressively and try to hit a line drive to the back fence. Maximize the arm's acceleration by avoiding any body distortion. I'm showing you how to do this below, and these photos, except the last one from behind, were done in succession (continuous shooting) and the ball did what it was supposed to. It surprised me how quiet and effortless I seem, but my stomach, leg, and butt muscles anchor me, and by isolating my shoulder and arm muscles the rest of me quiets down for top acceleration.



How many times? Just a few to start with, you'll notice your biceps enlarges, your arm tires. I wouldn't suggest doing this on successive days. Similar to weight lifting, practice at the most 3 times a week, skipping a day in between, and work your way up to 3 sets of 10 reps each. And you can do this against a practice wall just as well.

You are practicing and reinforcing and improving what the arm does out of the back-scratch position with this drill. When you return to performing the entire serve muscle cognition (muscle memory anyone?) will kick in to your benefit.

If you can't hit the back fence on the fly satisfy yourself with first hitting the ball beyond the baseline, then halfway between the baseline and the fence. Of course if you moon ball the drill you increase your chances of hitting the opposite fence, but that defeats the purpose.

### **DON'T CHEAT**

Make sure you don't cheat on this drill. Cheating means: rotating your shoulder a lot so you're twisted over when done, or lifting your back heel off the ground at the end, or taking a step. Remain grounded, firm, knees flexed a bit, fire your ab muscles, flex the arm, snap the wrist.

TENNIS magazine had a "Serve" issue, March, 2005. Pros Nick Saviano and Brenda Schultz-McCarthy's advice proved spot-on, but celebrity teacher Rick Macci's contribution on improving racket acceleration raised my eyebrows.

Rick's idea of developing a "fast arm" (racket acceleration) are framed within a bigger picture of how to practice isolating the upper body on a serve in case you have an abdominal injury (don't even serve if you have an ab injury). He asks you to stand inside two ball hoppers to keep your legs quiet in order to force you to merely swing without taking a step. The photo on the right shows his student standing, sideways by the way, inside two empty plastic ball hoppers. Seems like a lot of trouble finding not only one hopper but two, and emptying them of tennis balls, and making sure they're plastic and not metal so you don't scratch the court when standing inside. But standing inside ball hoppers? They're small, and can trip you up, literally, and you fall flat on your face. Are tennis camps immune from liability in Governor Jeb Bush's Florida? Open the stance and eliminate the hoppers. Keep it simple, safe, and low tech.

Rick further advises having your coach or friend toss the ball for you to help you speed up your racket, something about how putting you off your timing speeds up your racquet. I guess you're always going to need someone to help you...? I guess throwing you off your timing is a good thing...?

Enough said. [Macci photos TENNIS, march, 2005, photos by Manuela Davies/PROPIX]





# Revolutionary Tennis

## Tennis Instruction That Makes Sense

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Serve:

### HITTING UP SERVE DRILL

© Mark Papas  
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You often see a teacher serving from a kneeling position to illustrate how to learn to hit up on the ball. Besides hard on the knees learning how to serve from a kneeling position isn't pragmatic, and using a full swing to learn how to isolate the portion where you swing up doesn't teach you how to work exclusively on that portion. The focus needs to be on how to learn to hit UP.

I illustrate how to isolate and work on the upswing by sitting on the court, cross legged. If you can't cross your legs feel free to sit in any old position, one knee up, one down, both up, whatever. Put the racket down the back and hold it relaxed, we're not working on the down-and-up rhythm part of the swing or even the follow through. Toss the ball on the low side and try to hit the ball over the net. WARNING! You may swing down and slam the racket into the court by your feet and break your racket. The parallel green lines in photo #4 show that you stop the racket from going down and touching the court. If you hit UP the racket doesn't hit the court and the ball clears the net.



Next try to get the ball in the service box this way. It's doable. You learn to swing up, to use the wrist, to feel the serve grip better. Of course you will not be hitting the ball hard, that's not the point, that job is for the acceleration drill. After a quick few over the net stand up, do the full swing, and pay notice to hitting UP when it's time.

[Btw, the ball did clear the net and go in. No one really tells you with these things.]



# Revolutionary Tennis

## Tennis Instruction That Makes Sense

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Serve:

### WRIST SNAP DRILL

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The wrist is too delicate to fool around with, any isolation exercise must be approached with caution because the wrist can easily be strained. If you literally isolate the wrist the range of motion used is small, as in wrist curls with weights or squeezing an object in your hand. Isolating the wrist for a tennis serve must be done carefully to avoid injury and within the context of the serve itself to develop real-time muscle memory.

**Objective:** increase wrist snap, its use and familiarity.

**Goal:** from your service line snap the wrist to bring the ball into the opposite service box.

**Method:** open your stance, bring the back foot around to simulate an open forehand groundstroke (protecting your shoulder since you will not be shifting body weight or swinging fully to assist), and place the racket behind you and down the back (the back-scratch position). Relax the wrist and arm. Toss the ball, no need for a "perfect" toss here. Swing up and aggressively snap the wrist but **STOP the racket** immediately after the snap to isolate the wrist snap - keep the **arm/hand/wrist up** (the arrow) and the **racket** points down and stops moving (the two parallel lines). Pause after contact in this position for memory, arm remains very bent.



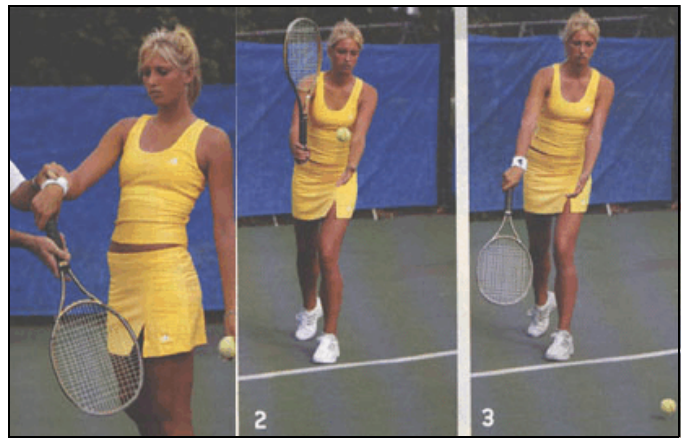
This emphasizes a singular wrist movement. It is a single-plane snap, not a multi planar snap, because you are not hitting up and for distance and power and getting it in. But you need to get the hang of loosening the wrist and of isolating only this movement (which occurs within a host of others).

Undoubtedly you won't get the ball in the opposite service box at first, but soon you will. You'll notice how you need to stop hitting the ball for length and instead need to stop the arm in order to spank the ball down into the court. In so doing you will be reinforcing the arm's configuration just after at contact - the pretzel.

This drill, or any other wrist drill for a tennis serve, can be murder on the wrist. Proceed with caution, and hit only a few balls. After you can snap the ball down into the box a few times please stop the drill and return to the baseline and apply this element at the end of a full serve with a full swing.

TENNIS magazine had a "Serve" issue, March, 2005. Pros Nick Saviano and Brenda Schultz-McCarthy's advice proved spot-on, but celebrity teacher Rick Macci's contribution on improving the wrist snap, hitting what he calls "wristers," raised my eyebrows.

He writes: "Start with a bow in your hitting wrist (photo 1 left)... Lean forward slightly at the waist... toss the ball in front of you and bend your wrist back (photo 2) and snap the ball down using only your wrist (photo 3)... you want the ball to make a loud sound and a high bounce." Rick's student shows his ideas.



Feel free to try it out if you want, you decide which method better reinforces the wrist snap from an overhead position for a tennis serve, which method least leads to injury, and which method makes more sense.

[Macci photos TENNIS, march, 2005, photos by Manuela Davies/PROPIX]

## THE MYTH OF THE TENNIS "MYTHS"

It always seems someone is declaring some point of a tennis teacher's instruction a "myth," as in it's a myth to take the racket back or see the ball, or some pro shows you one photo of a player in action to "prove" his opinion one way or another. Barkers demanding attention belong to the circus, Las Vegas, or Amstersdam's RLD, but not to tennis. And shame on these "myth" busters, some who have advanced degrees, because their self congratulatory and silly rhetoric not only turns people off but implies tennis is unsophisticated and perhaps isn't worthy of one's time.

**Revolutionary tennis** will show how a lot of these "myths" have value and that the arguments to them either are too narrow to draw the "myth," too simplistic, or sophomoric. I'm sure you've seen some of these and just shaken your head wondering why the tennis world tolerates them.

### "MYTH BUSTERS: RACKET BACK"

"One tennis myth started with the first instruction in this joke -- "Racket back," which... has caused numerous stroke limitations in literally millions of tennis players."

"...Why so much about power and topspin alongside the myth buster that "Racket back" may not be ideal instruction? Simple. To generate effective power and topspin on groundstrokes, and contrary to the popular instruction to take your racket back, you do not want to take your racket back and have it pause in the back position waiting to start the forward swing [photo right, top]."



"What's the alternative to the instruction "Racket back"? How about "Racket set" [photo right, bottom]? The difference between the two is where the pause takes place. In taking your racket back, you pause with your racket all the way back to its farthest backswing position. When you set your racket, you have a slight pause after a partial backswing, basically just far enough so your racket points straight to the side, approximately parallel to the net. Then, from there, when it's time to start your letter C loop swing, you end up with the racket in continuous motion until you strike the ball. Remember that you will still end up with a similar backswing to what you are accustomed, it's just that you pause at a different time in the swing."



[Using the web site's quote above, you do take the racket back but shouldn't "have it pause in the back position waiting to start the forward swing" but instead "have a slight pause after a partial backswing." In other words the racket still needs to "go back"

doesn't it? Where's the "myth"?

What he really means is the racket shouldn't drop down too early and leave itself motionless prior to the forward and upward swing. This has nothing to do with taking the racket back and is itself a separate major issue. Dropping the racket down too soon is probably the one reason more than any other for unrealized forehand potential. I see it in players, in teachers teaching students. The student starts the loop well but drops the racket too soon before swinging forward into the ball.

"Take the racket back" is all about reminding you, the student, to start the *process* of taking the racket back *early enough* to avoid being late. As a teacher I find students often don't start (the process of) getting the racket back soon enough, which means they don't start the loop but hold onto the racket with both hands.

I find students who hold onto the racket with both hands while turning to the side like in the second photo above miscalculate their spacing. They take 2 or 3 steps looking this way (or just wait) and miss-time the ball because, I think, their brain isn't getting the right information with two hands still on the (forehand) racket. When the student removes the off hand the spacing and timing issues disappear. You can still "turn" holding onto the racket throat but you need to let go right away to give your stroke the best chance at success.

No matter how you cut it "take the racket back" is valid. Personally I use "racket up" on the forehand loop, and then add if needed, "all the way back (racket head still above the hand), keep it up, drop-and-hit (at the end)."

And let's not forget the guys who say it's a "myth" to take the "racket back" because it never literally points straight to the fence behind you as you run over to a ball. One guy distinguishes this "myth" as "theoretical knowledge" vs. "application knowledge" because the pros don't do this (which is literally true, almost no one does). Of course we'll forget just how the pro learned about racket preparation to begin with.]

## **"MYTH: KEEP YOUR EYE ON THE BALL"**

"Most likely, the most often heard comment in lessons is, "Keep your eye on the ball until it hits the strings". If that's so important, why do we have thousands of shots of famous players looking over the net while the ball is being struck? The simple answer is, no human has ever seen a ball hit the strings because (1) the ball is on the strings approximately four milliseconds, and (2) the human eye can't record a four millisecond event. [Perhaps the human eye can't record a .004 event as it occurs in perfect focus but we have plenty of pictures of players "looking" at the ball on the strings at contact. Pictures where they are not serves to show how hard it is to do and not that it can't, or shouldn't, be done. Anticipating for the event helps to see the blur of the ball at contact. And is it true "no human has ever seen a ball hit the strings"?]

"The swing you make is a product of some electrical signals sent from the brain to the muscles. Send the signal too late, and you're in deep trouble. The message for muscles is normally sent down from the brain at about the time the ball bounces. Depending on the speed of your



opponent's shot, that's often approximately 150 to 200 milliseconds before impacting the ball. Thus, your eyes trying to follow the ball into the strings is useless because the nature of the swing has already been determined. Don't you remember how silly you looked one time when you tried to change your swing at the last minute and the ball went over the heads of players on the next court. [The message to the muscles doesn't have to come from only the brain as assumed here, research written in a 1994 newspaper article indicates a loop back with the spine that explains faster response times. And this math is only for an extreme example, most players have more time than that.]

"To make matters even worse, most people suddenly become legally blind on the last 5.5. feet of incoming ball flight because the rapid eye movement trying to track the ball normally generates blurred vision. Dr. Bernie Slatt, after doing some post doctoral studies on eye displacement, wrote a book titled, "Hitting Blind". Vision specialists have looked into this issue for the last twenty years, but the myth continues. [You lose the ball if you try and see the ball literally all the time like a movie camera panning the horizon, the eye sees at fewer frames per second and can't see it literally all the time. The eye sees in sections, and to "see" the ball at contact the eye will, milliseconds before contact, look, or jump, ahead to the spot where/when the ball will be hit. In this way the ball, the eyes, and the racket hopefully converge at the same time.]

"But hold on, your coach may have something else in mind. If you pretend as though you are watching the ball into the strings, your head will remain quiet and will not disturb your swing pattern. In biomechanical studies... in the early 80's, Dr. A and I would constantly notice the swing pattern changing when a player's head made a sudden shift. That's partially because your head weighs more inch per inch than any other segment of your body. Thus, even though your brain has sent down a signal for a perfect stroke, it has also sent a message to shift your head, and the stroke pattern is destroyed. Most coaches call it, "Pulling off the ball too early". It's not uncommon to see a professional player do this and hit the ball into the stands. [The eyes are the initial and primary trackers of the ball in flight and the brain "swings" the racket based first on the information the eyes give it, secondary informational sources are involved milliseconds prior to contact and do not involve signals to/from the brain. A still head prior to swinging enhances vision acuity because head movement moves the eyes. Last minute head movement signals a change in plans to your brain and nervous system, thus the change in the swing pattern in this study. Furthermore any last minute head movement occurs as a result of body movement and swing. Your brain is not signaling you to move your head as the author states, consciously or subconsciously. Why would it? But a still head will do you no good unless you do try and watch the ball in, don't you think?]

"It's really difficult to convince players that they can't see the ball hit the strings. "Your wrong, ..., my next door neighbor, Helen, says she can see the Wilson logo as clear as a bell when it's on the strings". That a statement I've heard quite often and my response is always the same; "You just live close to a liar". [Shows disrespect for tennis players, and a belief that he alone is right.]

[The big picture here is this. A pro has learned to look at the ball into the string bed since s/he was 6 or 7 years-old and has developed an acute sense of hand-eye coordination brought about by a gradual and progressive process. This learned coordination allows them to return powerful



shots when photos show they are not watching the ball literally into the string bed.]

## **"MYTH: TOSS THE BALL HIGH ON THE SERVE TO GAIN MORE TIME TO STRIKE THE BALL"**

"...The problem is that the ball falls [from the toss, when up] at the rate of gravity, 32 ft. per second/per second. That means the server must strike the ball on the way down. Depending on the size of the rackethead and the acceptable area on the racketface where the ball can be struck, a ball thrown only to the peak of one's reach and hit at the apex will provide the server with 10 to 15 times more time to strike the ball. The high toss will provide a server more time to prepare to strike a ball that is in the window of the racket face less time.

[It is not a "myth" the high serve toss gains more time to strike the ball, the last sentence admits to it: "the high toss will provide a server more time to prepare to strike a ball." The real question the author poses is whether it is better to have more time to prepare to hit the ball or hit the ball when the ball is in the window of the racket face for more time.

A toss to the peak of your racket's reach rises slowly, pauses, remains within the window of the racket face all the time even before it drops back down out of the window with little acceleration. A higher toss quickly rises through the same racket window and goes above it, and when it drops back down it goes through the racket window faster than the low toss. In one the ball doesn't stay up in the air for very long, in the other it does.

When measured in absolute terms the low toss remains in the racket window for a longer time than one tossed higher but the claim "10 to 15 times more time to strike the ball" is specious. The low toss gives your stroke less time in which to hit the ball because the ball is up in the air for less time than when tossed higher, and the low toss means you have to speed up your swing.

Ultimately what is the "time" here we want to gain? Do we speed up our swing because we think the ball has more time to be struck, or do we give ourselves more time to swing at the ball?]

To be sure, the majority of the players use the high toss because that's the way they've been taught [in the same manner players developed the open stance not because they were taught but due to need we would see more apex-height low tosses in the pros but don't] . A great contributor to tennis science, Dr. B calculated that one could get a few more topspin revolutions on the serve if the ball were struck on the way down, but he simultaneously stated that the number of revolutions gained weren't earth shattering [any extra revolutions on a 120 mph serve affects ball movement and success]. He also stated that his calculations weren't meant to measure the effects of the racket swing pattern and the issue of timing a dropping ball.

Some German and American scientists feel that the high toss gives the upper body a chance to coil in such a manner that it loads the musculature and facilitates a much faster swing [More time does give the body a chance to coil or do anything "more," as a higher toss gives you more time to strike the ball, but does that directly equate into racket acceleration? If it did the fastest server would display the greatest coil or knee bend.] In the ...Research Center, Dr. A and I did not

come to the same conclusion for the use of a light implement, such as a racket. We were, however, in agreement with Dr. E's research showing that the proper internal rotation of the upper arm provided the greatest rackethead speed.

Pete Sampras leads with the left hand. Steffi Graf led with the left hand and one could see her service toss rise above the first balcony, but senior player, Roscoe Tanner hit the ball at the apex and is still hitting serves harder than many players active in today's Open tournaments. [Roscoe also leads with the front hand, and perhaps if indeed he tossed at the precise apex and is basically alone in doing this one must consider the uniqueness and rarity of it since others have not easily imitated him. It should be considered, respectfully, that perhaps it is indeed easier to time a dropping ball than one at the apex.]

### **MYTH: STEP INTO THE BALL FOR MORE POWER**

"One day, I strapped a racket to my body, turned on the ball machine, stepped into the ball and managed to get about six miles per hours more speed on my forehand shot than simply letting the ball bounce off my stationary racket...

"So, why did I only get six mph more speed when I stepped into the ball with no arm swing? Dr. B discovered, the speed of your shot is determined by getting approximately 1.5 times your rackethead speed, plus one-half of the incoming ball speed. That rule applies to both ground strokes and serves. That means I was stepping into the ball at about 4 mph and 1.5 times 4 got me an amazing 6 mph more speed.

"In a biomechanical study Drs. A, V and I did on Andre Agassi, we found he uses the forearm muscles, and physical principles, a little differently than most tour players. The majority of players generate rackethead speed by coordinating body link coiling and uncoiling, often called "The kinetic chain". One argument is that when one steps into the ball, there is a capability for greater body coiling and uncoiling. That also happens to be a myth, which will be discussed in another issue."

[Power in tennis, everyone agrees, is racket acceleration. The question here is do you get more racket acceleration if you step into the ball than if you don't? The author answered his own question, and the answer was yes.

The author takes offense that it was *only* 6 mph difference and then uses physics to infer there must be another way to get the racket to accelerate to 41.66 mph (to return a 90 mph groundie at the same speed). But how does strapping a racket to one's body and taking one step with no arm swing constitute an experiment proving or disproving it's a myth to step into the ball for more power? You can't be serious.

The easiest way to see how a step works in athletics is when a boxer steps onto his front foot, shifts his body weight, and snaps the jab. Athletic endeavor involves shifting body weight in one form or another to empower the athlete (athlete's limbs). In tennis we shift body weight prior to the stroke, no matter if we hit off the back foot or front foot, use linear or angular momentum.

We just can't not move the body and hit, even if we don't step. And as with other athletic endeavors the step prior to the delivery (swing) relates to timing, coordination, and rhythm. You see this when you step and throw a baseball, step and shoot a basketball, or step and kick a soccer ball.

When learning to play any sport you learn to develop athletic ability. In tennis you learn what is the bread and butter to athletic endeavor, stepping and then executing, i.e. stepping into the ball and then swinging in our case. Of course this step is replete with pitfalls, as in you shouldn't step sideways or across in what's called a closed stance, you shouldn't step to the net or to where you want to hit the ball, you shouldn't take an arbitrarily long step. Because of these pitfalls and false ideologies players both past and present out of need developed a more open stance and large body rotation.

Bottom line it's not a myth to step into the ball, in fact that is what you have to do to develop your own athleticism.

The question of how to hit "for more power" belongs to which stance produces more power, open or front foot. Studies favor the front foot by a slim margin, and I'd agree, but I also know these studies are not that smart. I'm not talking about how hard it is to isolate the many variables involved in any tennis study, I'm talking about the set-up. In "Trunk Muscle Activation in Open Stance and Square Stance Tennis Forehands" they concluded, "The nonsignificant differences in muscle activation between stances did not support the belief of tennis experts that open stance forehands require greater trunk activation than square stance forehands."

I emailed the people involved a series of questions pertaining to their discovery methods. Players were literally standing still and swinging, either from an open stance or taking literally one step and hitting the ball, they did not move into position; the ball was bouncing off a carpet square; they didn't care how the weight shifting was done with the open stance (there are two ways); players were allowed to do whatever they wanted in terms of leaving the ground (some jumped, others transposed back foot to front foot); players were told to step forward toward the net where the front toe was pointing to the net (instead of to the ball).

So here we have "science" "experts" telling us the study does not "support the belief of tennis experts"... As a player I know my trunk muscles are not only taxed but activated much more in an open stance than a square stance, and so do you.]

## **MYTH: BUY A RACKET THAT IS “FORGIVING”**

"There are those who feel that the racket will actually make corrections when the ball is struck incorrectly." [The author says you think "forgiving" means the racket will hit good shots for you all on its own. I'm sure "forgiving" to you means when hitting off center the racket doesn't seem to vibrate or tweak too much in your hand and that the ball doesn't really sail if you don't hit it pluperfectly. "Forgiving" also means forgiving on the arm, as in the frame is not too stiff or too flexible for you and doesn't jar the arm. Yet another example of underestimating the intelligence of tennis players.]

### **MYTH - KEEPING YOUR EYE ON THE BALL TO HIT THE SWEET SPOT OF YOUR RACKET**

[I don't know if keeping your eye on the ball guarantees you will hit the sweet spot of your racket, but I do know you need to keep your eye on the ball in order to have the best chance of hitting the sweet spot of your racket. So where's the myth?]

### **MYTH - YOU MUST STAND STILL AND BALANCED TO HIT EVERY SHOT**

[No one advocates that, it is a teaching method to help you learn, i.e. freeze. You must be stabilized to hit well, now does that mean still and balanced? I don't know about the still part but the balance yes, it's called dynamic balance, not standing still literally. And every shot? That's exaggeration, falsely used, to prove a point lacking substance.]

### **MYTH - YOU SHOULD MOVE YOUR BODY WEIGHT INTO THE BALL ON ALL OF YOUR SHOTS**

[This is because the author points out pros sometimes go backwards when hitting their shots. I guess he means when running down a lob. Even when incorrectly going backwards on a ground stroke pros stop and move their body weight into the ball by any means available, it's called athletic execution. Upper body rotation alone is moving body weight into the ball..]

### **MYTH - YOU MUST HIT YOUR GROUNDSTROKES WITH A CLOSED STANCE**

[By closed stance he means the front foot steps literally sideways. Closed (including square) stance is used to juxtapose open stance, but stepping with the front foot prior to contact is not a myth, it is sound advice. Stepping sideways with the front foot is not a myth, it was a reality in tennis textbooks and still exists in print today. The fact you should not step sideways in what is called a closed stance, favoring either the open stance or revolutionary tennis' forward stance that has the front foot stepping to the ball (strictly defined as a closed stance because it is not open), means this closed stance business was a total misunderstanding on the part of earlier tennis teachers regarding athleticism in tennis, not a myth. A myth was that at the edges of the flat earth monsters would await seafarers and eat them alive.]

### **MYTH - CONVENTIONAL METHODS OF TEACHING TENNIS ARE NOT BASED ON THE NATURAL AND SPONTANEOUS WAY THAT PROS PLAY**

[Just how do pros learn to become natural and spontaneous, what did they practice as kids? Naturalness and spontaneity? No, convention. The best professional shortstop in the world can dance off of one foot and zip the throw in to first base off balance precisely because he practiced scooping up the ball with two hands, turning his body, planting the back foot, stepping into the throw with his front foot, releasing at 3/4 delivery angle, following through to his target.]

### **MYTH - YOU SHOULD BEND YOUR KNEES ON ALL OF YOUR STROKES.**

[He means just not all of the time, and not deep knee bend style. So where is the myth?]

## **MYTH - YOU MUST PRACTICE PRECISE INTRICATE FOOTWORK TO MOVE ON THE TENNIS COURT AND PLAY TENNIS WELL**

[He admits to (intricacies of) hitting off of a particular foot, taking adjustment steps and "straddle" steps, so where's the "myth"? But he tries to gloss over footwork skills by saying it all comes together "naturally with improved timing and judgment of the ball. Really!!!" Steps are taught students who quickly see it comes rather naturally if you either start or end correctly. Tennis is not ballroom dancing, a discipline that indeed involves precise, intricate footwork.]

## **MYTH - YOU SHOULD STAY ANCHORED TO THE GROUND WHEN YOU HIT MOST OF YOUR SHOTS**

...The pros jump off the ground on most of their groundstrokes, especially their power topspin shots. Jumping off the ground is a natural result of letting go and offers three important benefits. 1. More power 2. Improved fluency 3. Better balance... Here is the bottom line. The pros jump off the ground because they know instinctively that it is beneficial. You should do the same. Play without forcing yourself to stay on the ground and as a result jumping will occur naturally and instinctively. You will be playing and thinking like a pro! [Anchored is the modifier here, and it tries to spin for self benefit a "myth" of worthy advice. The only "anchor" in tennis has been the back foot, not the body, not both feet. Teachers know you won't be literally anchored during contact, but neither do they expect you to jump because the forehand is not a jumpstroke. We jump to relieve stresses and conflicts, we jump to shift body weight while being unable to step into the ball because we are there ahead of time, we jump because we are simply moving more and swing harder. But jumping has never been part of any teacher's technique to help you learn to hit well, to reinforce sound technique you stabilize during the swing. Which is what pros look like when they warm up, when they practice, and which they try to do when they play but can't often since the ball's going so fast and they have to run and get there and hit hard and... often leave the ground. This is not a myth but a sound teaching axiom, and if you are losing control when playing kick in the stabilizers.]

**MYTH - TO LINE UP THE BALL ON YOUR OVERHEADS YOU SHOULD POINT YOUR FINGER UP AT THE ONCOMING BALL BEFORE YOU HIT IT.** Just another variable to think about that is NOT necessary.... Some pros point at the ball, some pros have their elbow up, and some pros have their hand up. [How is this a "myth" since he admits that pros do it? I think he means pointing is not the only way to line up the ball.]



# Revolutionary Tennis

## Tennis Instruction That Makes Sense

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### All About Body Rotation

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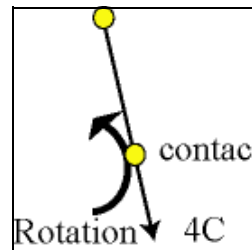
This is a progression on body rotation compiled from Steps 4, 6, and 8 that helps clarify the unique proposition that body rotation is counter productive to success for a tennis player. It shows that while a very limited amount of upper body rotation can exist to help begin the process to racket acceleration, body rotation in and of itself is by no means solely responsible for acceleration or power. And it shows how and why to rotate your body the right way if you need to do so. As always, it turns out that less is more.

#### From Step 4

Shifting your body weight is your body's source of power, shifting body weight empowers your limbs for the job at hand. Step 4 argues that linear momentum for shifting body weight is a simpler and more consistent method than angular momentum, and ends with the concept for advanced players that very limited upper body forward rotation to start the swing is possible.

Body rotation is designed to shift weight if you're not moving into the object to begin with, or if you're standing still prior to contact. But a tennis player gets to move, and should take advantage of this huge benefit by moving into the ball instead of to the side fence.

Body rotation by definition means the body rotates inward from the contact spot, no matter the sport. From overhead, the trajectory of a tennis ball is a tangent line, angling away from the player, and it continues to angle away at contact. The direction of the body's rotation here is inward from the tangent line, inward from the contact spot (4C).



Or look at it this way. Stand and face your computer monitor. Draw an imaginary line perpendicular to it from your navel. This line has a fixed length to it. Rotate your body to one side and notice how your imaginary line arcs inward from the monitor.

As a tennis player you face the reality of a ball angling away from you. If you rotate your body during the swing, this means you're moving away from the ball at the same time it's moving away from you.

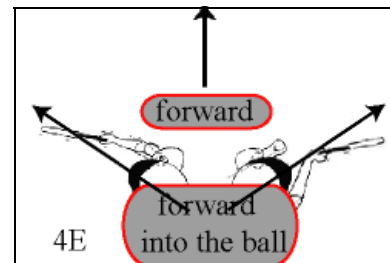
Linear momentum is an easier and more reliable source of power than angular momentum. Its mathematical equation is simpler as well. When a tennis player rotates, it's overkill, counterproductive, and everything gets more complicated. What happens when a golfer or batter tries to hit the ball harder? They rotate more, and their accuracy suffers.

## LINEAR BODY WEIGHT SHIFT

The length to the linear shifting of your body weight is small. This is the main advantage, there is very little “shifting” to do since you’ve been moving into the ball. The tennis balls placed below the center of my body in photo 4D represent this length, and the arrow shows the direction of the shift. Aggressive players will add more length to this shift by taking a longer stride.

Let me show the direction in which your weight shift should proceed. 4E shows the difference between shifting your weight forward into the ball, or shifting it "forward" toward the opponent in the direction of your stroke, which isn't forward into the ball. You shift into the ball, and there is only one direction for that.

If you're like most players, often your momentum has been going to the side fence. You're sideways, and to compensate you'll rotate your body to redirect your momentum more into the ball. Unavoidably, this rotation adversely impacts your stroke.

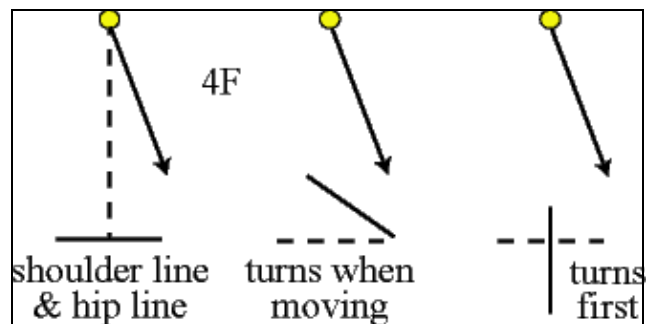


Or, you'll rotate your body to generate momentum from an open stance because you've stopped moving, you won't step into the ball. Ironically, this momentum from rotation will not go into the ball but away from it, the largest single source of unforced forehand errors in the pros. On a replay after the pro has netted an easy forehand, notice how severely he or she rotated the body inward from the contact spot toward the opponent's side of the court, that is away from the ball.

I know the idea of no body rotation is different. It runs counter to the established method. Well, if you move into the ball correctly with both feet, step into it with the front foot, shift your weight linearly into the ball, and don't rotate the body during the swing, you'll be amazed at how strong your contact is with linear momentum as a power source. Large muscle groups are still responsible for transferring weight, only now their contribution is linear, not rotational. This is a new idea. **Revolutionary.**

## LESS IS MORE, SIMPLE IS BEST

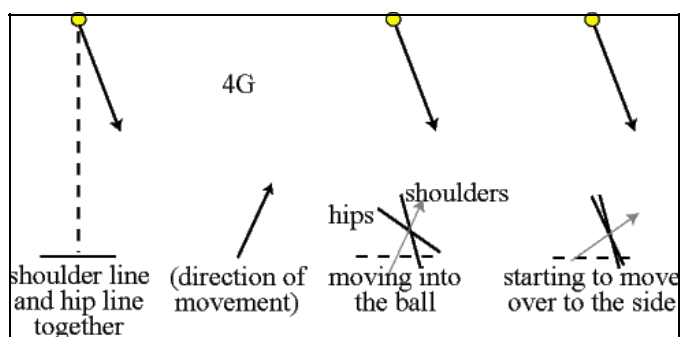
Let's talk about turning the body, because I know the popular idea is to "turn" the body when you take the racket back. First, when you move you automatically turn the hips and shoulders, it doesn't work the other way around, shown in diagram 4F. Movement = turning, as illustrated when hitting on-the-run forward into the court. Very few students move across the court with their shoulders parallel to the net.



Second, if you turn first, you've turned the body and its momentum away from the ball. With this

over-turn, you'll have to re-turn the body into the ball to support the stroke at contact. All of that adjustment, especially in such a short amount of time, adversely impacts any swing. Compensatory technique should not be offered as a model.

Third, and last, what about the popular idea of turning the upper body a lot first, winding it up, to accelerate the stroke more via rotation? Step 6 elaborates on why this doesn't work, but for here let me refer you to diagram 4G. As long as your hips and feet (your body center) lead you into the ball there will be a limit on upper body rotation, or wind up. If, however, you

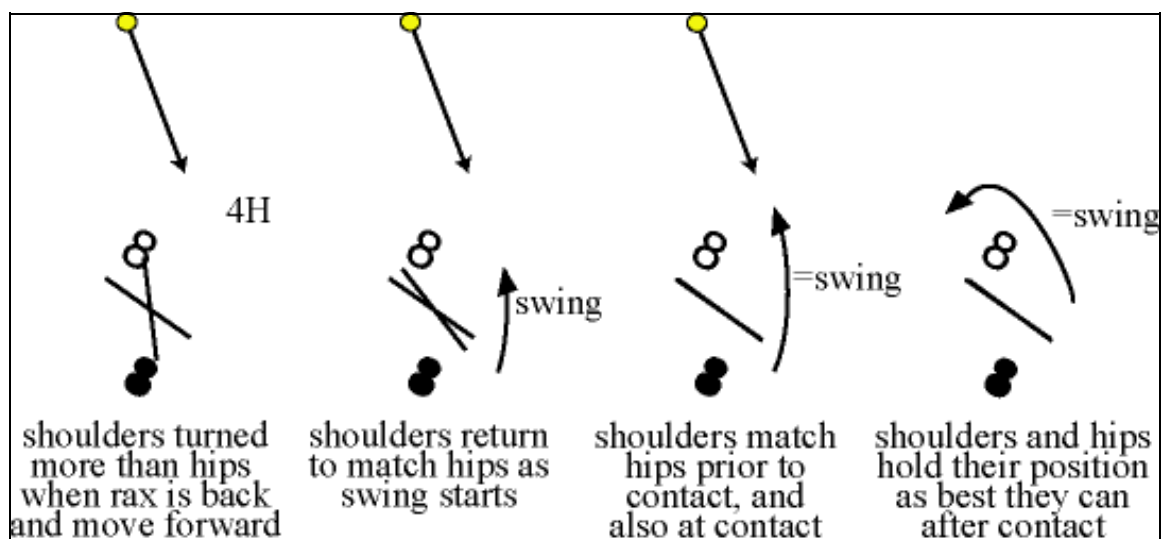


allow your hips (body center) to turn more because the upper body winds up, you'll find yourself and your momentum no longer moving into the ball but away from it. Your stroke then needs more time to curve its way around to line up into the ball, and, more importantly, hitting on time becomes more difficult to achieve (more on this in Step 7).

### FOR ADVANCED PLAYERS...and those who aspire to be

I have received a lot of feedback regarding upper body rotation on a forehand. For advanced players the answer is yes, there is some, if you want to call it rotation. But when I asked a student of mine who's an attorney whether or not she considered what follows to be rotation, she answered, "Not really, because I'm trying to lock my torso after a point." Let me explain. What follows also applies to two handed backhands.

Diagram 4H begins, like 4G before, showing the limit to the upper body's coiling, or turning, while moving forward into the ball. Next, during the forward swing, the torso re-turns to match the angle of the hips beneath it, something it wants to do quite naturally. And if the torso stops when it matches that angle it acts as a boost to get the racket going. By stopping its limited rotary movement, the torso helps accelerate the racket ON ITS OWN. This is similar to cracking a whip, where the handle stops and the rest of the whip accelerates and continues beyond it, or similar to a hammer throw, where the body prior to release stops its rotary movement to help the arms accelerate the throw.



The stroke does not accelerate as much as explained above if the shoulders continue to rotate (and the hips) in the direction of the swing and wind up facing the net. There is a point in tennis where rotary movement becomes counterproductive to stroke speed and contact control, a point easily breached when either hips or shoulders rotate to face the net in an effort to accelerate the swing. Tennis is not golf or baseball. We need to move, adjust our stride and closeness to the ball, adjust the stroke, exercise more control over the hit, keep it in a small playing area, and get ready to do it again a few more times for one point.



I'm including a photo here of the great Stan Smith to illustrate the movement in 4H. Stan's explaining something about hitting down the line with these two photos, but a few things prominent to **Revolutionary Tennis** stand out even though these aren't mentioned in the article. It's clear that 2 steps are taken prior to contact and that both feet are identical, or pointing into the ball (**Step 2**). Stan's shoulders are turned more than his lower body (photo left), and then his shoulders re-turn to match the hipline (right) per diagram 4H. His contact spot lies between the width of his feet (**Step 3**), and his overall posture is good (**Step**

**5**). This photo by Fred Mullane appeared in Tennis magazine.

How can you learn the movement described in 4H? First, move into the ball and don't coil the upper body as you begin taking the racket back. Your torso will be turned slightly like your lower body. Then step into the ball with the front foot, shift your weight linearly, and swing without moving your torso or hips. A common teaching tool is to freeze after contact, that is follow through and freeze. The "freeze" stops body rotation and produces a strong hit.

As a teacher I find students naturally turn the torso slightly on the forehand when taking the racket back, and they naturally overrotate the shoulders forward with the swing. I guess you can't have everything. So my job is to get them to stop that forward overrotation to improve their stroke.

Some players hit successfully after both moving parallel to the baseline and rotating the body. This is good enough, from time to time, but it's harder to make this style consistent because rotation compensates for not lining up properly INTO the ball to begin with. When faced with a harder or wider ball, the weakness in this style is exposed. Furthermore, this kind of player would like to have more power yet keep the ball in. How to? Cut down on the rotation, and try moving into the ball to begin with.

Contact, for any sport, is preceded by shifting body weight into the contact area, you shift and hit. For tennis players it has been said that the timing of the rotation of the body (body weight shift) with the swinging of a racket onto the ball is crucial for success. Wrong sport. Tennis players need not rotate like golfers or baseball batters. Nor should they. And if your power isn't what you want even though you're moving into the ball and using linear momentum for your weight transfer, Step 5 will assist you.

Using a metaphor, the perfect swing works as smoothly as a child's swing swinging back and forth between the legs of a swing set. But if Mr. Bully picked up the legs of the swing set and twisted

them, the swing would no longer move smoothly, it would fly off to the side. This is what happens when you rotate the body while swinging the racket, the racket can't line up into the ball smoothly.

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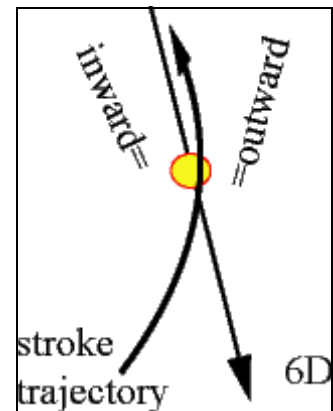
### From Step 6

Further the unique no-rotation proposition in order to accelerate the swing, which is itself an arc to the ball's tangent line, and begins the idea of the arm's leverage mechanics to advance acceleration.

## **WHAT ABOUT BODY ROTATION DURING THE SWING?**

The swing has the potential of ruining the body's foundation and support, Step 5. Its angular momentum and acceleration can pull the body away from the ball prior to and during contact because it heads in a direction separate from the body's focus (into the ball/contact).

The swing's trajectory is basically an arc that stems from a common origin (shoulder). Arcs accelerate in a direction inward from the trajectory, that is inward from the contact spot, 6D, which is why 6B's head-on stroking direction feels solid and strong. This sends the ball back in the same direction, often more to that one side.



There are times when you send the ball outward from the contact spot. Here the shot is weaker and the risk of losing control is greater: hitting inside-out, changing the ball's direction (though [Step 7](#) explains when changing the ball's direction plays to the stroke's strength), or responding to a sharply crosscourt ball (unless you hit it even more sharply crosscourt). Generally speaking, hit your best shot, through the middle of the ball. If you choose not to, understand the risk involved and don't go all out.

If the body rotates after the contact it's okay. This happens, the body doesn't remain still like a statue, the stroke pulls at you. However, if the body rotates during the swing, during contact as part of the swing for power, both power and control are sacrificed. You need to separate the empowerment structure from the delivery structure.

## **RACKET ACCELERATION**

Step 5 said: "To help the swing accelerate and enjoy the most strength and support from the body, the body doesn't move. Except for the swinging arm, of course. Your front shoulder remains still up through contact, 5J, acting as a brake against the force of the stroke to accelerate it. Rotation, besides moving you away from the ball and being a complicated power source unnecessary for tennis, creates friction during the swing and slows it down.

Now we'll add up what we've learned here in Step 6. A stroke's acceleration lies in a direction inward from the contact spot, 6D, and is greatest when there is a common origin, our shoulder and then elbow, in our case. [Extend your arm straight away from your body, keep your shoulder still, and swing the arm side to side. Next, move your shoulder side to side and swing the arm.



Compare the two speeds. When the common point, the shoulder, is still, the arm accelerates more. Furthermore, the arm pivots around this common point.]

When you swing the racket and move the shoulder(s) around you lose acceleration because the common point moves. The same happens when you shift your weight along the flight line of the ball, or when you rotate, the common point moves. I've said it before, and I'll say it again: Rotation for tennis players is counterproductive to success.

### **DON'T BE A STROKE GUZZLER**

Don't be a stroke guzzler. The idea is not to waste a natural resource, the arm, like an inefficient automobile engine wastes gasoline. You become a stroke guzzler when the arm moves too much as a whole, or when the arm is engaged as one unit or doesn't flex during the swing.

Let's use the same example above where you extended the arm straight away from you and moved it side to side keeping the shoulder still. Do it again and notice the speed at which your hand moves. Stop, then bring the elbow in to touch your stomach and move only the forearm side to side. The hand moves faster, doesn't it?

During a tennis stroke the shoulder is the first common point but you can't swing the racket with your arm completely extended or straight and expect good results. It's too slow, plus there's no leverage with the arm this way. You don't pick up a box with your arms straight, do you?

The elbow, then, becomes a second common point, or pivot point, during your swing. As you begin your forward swing the arm bends to pivot at the elbow, bringing the elbow in closer to the side of your body, and the biceps slows down. Here the shoulder relinquishes its role as the common point and passes the torch to the elbow, whose deceleration helps the racket accelerate more. On forehands the elbow passes the torch to the wrist, but not on backhands.

### **MORE ACCELERATION**

All in all the arm's parts compress into the body (to reduce their moments of inertia to increase the stroke's angular momentum) in an effort to whip the racket face around the arm and the body as fast as possible to hit the ball head-on. In a not so small way, this is similar to an ice skater spinning in a circle with her arms extended who then brings them in to spin faster. Of course we don't spin around, but for the small moment of a forward swing, the arms come in closer to the body to increase our racket's forward acceleration.

6F, left photo, shows the arm extended with the racket back. 6F top photo shows the arm coming in closer to the body during the forward swing for leverage dynamics, what you want. 6F bottom shows what to avoid, the arm extending away from your body laterally during the forward swing. 6G shows the arm folded, then unfolded during the swing for backhands in order to maintain leverage dynamics, you don't want to swing the arm straight out away from you. It's the same for two handed backhands, even though there are styles where the arms straighten and the wrists (not the elbows) act as the pivot points.





## WHAT ABOUT THE PROS?

Photo 6H, left, shows the arm placement a pro often uses when taking the racket back on the forehand. The elbow is up high, the arm is drawn back in exaggerated form, the body's coiling, the stance is open. But they, too, from this position, must adhere to the arm's leverage dynamics. If they don't, and a lot of them don't, their forehands aren't what they want them to be. The exaggerated use of the arm during a pro's swing is a symptom of inefficiency, much like low gas mileage for a large automobile engine.



The 6H photo on the right shows adherence to the arm's leverage dynamic: the elbow drops and the arm comes in closer to the body for leverage and speed, and will resemble 6F top photo right during the forward swing. Though some pros extend laterally on their forehands, it's definitely more the exception than the rule. On forehands you have to get closer to the ball than you're used to because stretching, or extending, equals leverage loss. And on backhands you have to resist straightening the arm as part of the stroke's objective because that, too, equals leverage loss.

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### From Step 8

Where pros' pictures bring home this idea. And if you have to rotate, this shows you how to do it and why.

## ROTATION... ROTATION...

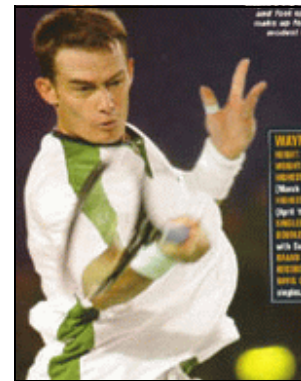
Step 4 explained the adverse impact body rotation has on a tennis swing, and that little rotary movement is necessary from the back shoulder to get the swing going or even to boost it. And if a little less than that comes from the hips, its controllable, at least. Sadly, though, the idea that if a little bit is good, a lot must be better. Not.

If the shoulders and hips rotate unabated, is there more power? Maybe in the world of sports scientists, who calculate that more "power" results when you rotate the greatest number of body parts and swing in arcs far away from the body. But how far do golfers rotate, or baseball players? Is their objective to face their playing field at contact? If baseball players felt they'd get more power by facing the pitcher at contact like a tennis pro facing the net, don't you think they would? But they don't, and neither should tennis players.

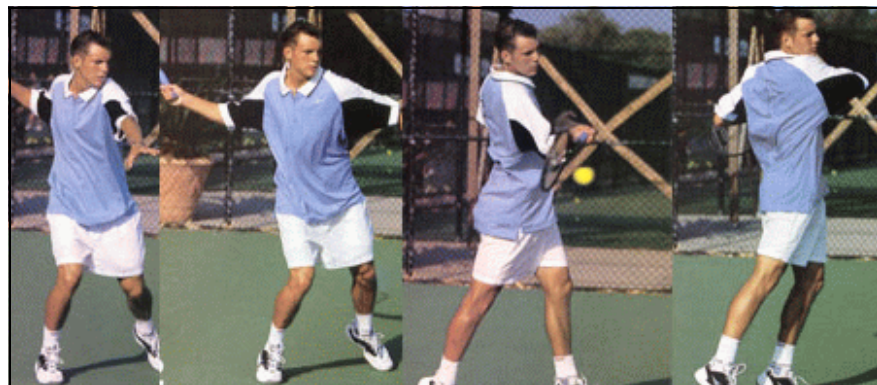
Step 6 showed how the acceleration of an arc (stroke) is greatest when the common point to the arc remains still. In tennis, this is achieved in one of two ways. Either the common point (the back shoulder on forehands) remains pretty still after a certain point, or the front shoulder acts as a brake against it to prevent it from moving too much (common on serves). When the common point moves around unabated, this acceleration principle is lost.

Today, a lot of rotary movement is sought on the forward swing. Too much. Not only does contact accuracy and quality suffer (because the ball is angling away from the direction of the rotary movement), but racket acceleration suffers as well. At the very least players with open stances and extreme grips should strive not to throw both shoulders around during the swing, they should strive at least to control the front shoulder and hand. The following photos explain.

Wayne Black's forehand contact matches up with a Bollettieri Academy student. Wayne's front arm acts as a braking action against the back shoulder to help accelerate the swing, which is why you can see the front arm, hand, and shoulder, whereas on the NBTA student you do not. The bend of Wayne's front arm and hand mannerism both still in front or ahead of his body explain the arm's braking action, if not the arm would simply have swung uncaringly around to Wayne's left side and out of the picture, like the NBTA student. The NBTA student has rotated both shoulders around way too much, like a boxer over swinging, which has pulled his front arm and shoulder out of the picture. Yes, it could be the camera angle, but I doubt it. (Wayne's photo Tennis magazine, 5/00, Rick Stevens/ap/wideworld photos. NBTA student, 1/00, Caryn Levy.)



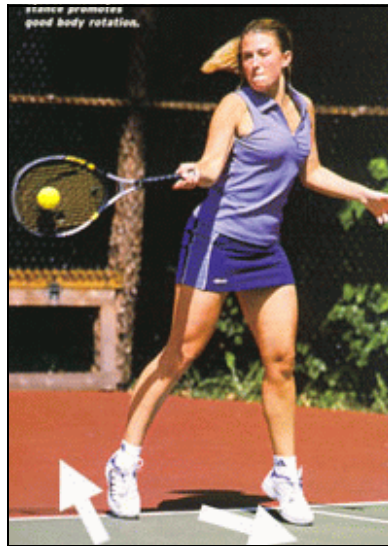
This is the entire sequence to the NBTA's killer forehand. It's clearly seen the emphasis is on "if a little is good, more must be better" idea to rotation. The rotation is exaggerated because the student's standing still prior to contact instead of moving somehow into the ball, even with the back foot.



The web site's instruction for this open stance is to "keep your weight on the outside foot until after contact," which I don't see happening here. As a result of exaggerated rotation, the follow through idea becomes similarly exaggerated.



More conflict follows. The young girl in the open stance receiving serve in the ad court is meant to illustrate the value of (turning and) releasing your hips into the shot (Tennis magazine's 101 tips issue, 10/99, photo by Caryn Levy). The two arrows I added by her feet show the historical incongruity of "how to play tennis." The arrow on the left shows the ball angling away from her, that is to her right, and the arrow on the right shows the direction of her body weight shift, which is to her left, perpendicular to the net, following the sideline. The



incongruity of the arrows speaks volumes. The two arrows need to intersect, the body weight shift needs to be directed at and into the ball at contact (per Step 2, 3, and 4). The photo on the right shows this happening, my feet (and thus body center) are pointed in the direction of the contact, which means I'm shifting my body weight there as well. (As a disclosure this isn't an action shot, I copied and pasted the ball onto my racket. But this form regarding the direction and placement of both feet and body equals success at contact, which is what Agassi does so darn well on the return of serve (upcoming in a later Step).

### HOW TO ROTATE... the right way

All right, I give in. You want to rotate you say? Let me show you how to and how not to.

If you're one of today's players, you're standing in an open or semi open stance prior to hitting a the ball. You're not going to step into it with the front foot, you're going to rotate your body in the direction of your shot, which is toward the net like the NBTA killer forehand above or the girl in the open stance. Or you're going to rotate so that you bring your back leg (and hip) around towards the net just as you'll bring your back shoulder around to the net.

If you're going to rotate, rotate INTO THE BALL as shown in the photo above next to the girl and not toward the net. If you're going to bring your back leg around, bring it INTO THE BALL, not toward the net. If you move yourself toward the net, you're shifting your weight away from the ball because it's moving away from you.

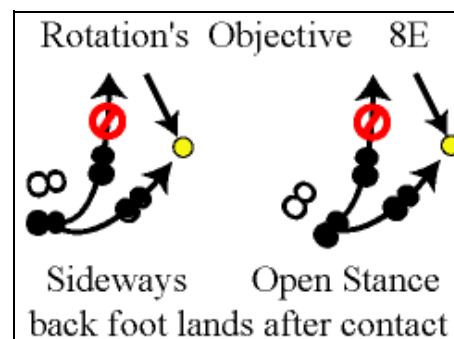


Diagram 8E shows what it's like to bring the back leg around out of the sideways and open stance positions. It is very common today to swing that back leg or hip around in the direction of the net (the red circled arrows) instead of into the ball. You see this in all developing players, their back legs swing around to the net and their forehands suffer. If you need to rotate please rotate out into the direction of the contact spot and not inside it toward the net. Remember, rotation is by definition inward from the contact spot. Rotating inward from the contact spot defeats the purpose of empowering the shot.

Rotation in and of itself does not accelerate the racket. Rotation acts more as an initial combustion agent, or first phase, to racket acceleration. I've mentioned earlier about the slight re-turning of the shoulders to initiate the forward swing for advanced players and those who want to be. The same applies to "rotating" the lower body if and when you find yourself either in a sideways position or open position. In both cases the solution is a little goes a long way. Obviously if you're sideways you can rotate more than when you're open, but then you always lose control when doing more.

Power is just awesome when you rotate (though inconsistent by definition) out into the direction of the contact to encompass the ball and time the hit just right. And then it's tempting to rotate more to get more. More for more's sake doesn't exist, in so many different variations. If so, the baddest bomb in our military's arsenal would be a truly large one.

The final point is you actually need to do less rotation to accelerate your racket more. It's not ironic, it's predictable. The primary responsibility to rotation is to empower the contact spot. Secondly, rotation acts as a boosting agent for racket acceleration. If you overdo this boosting part its friction slows down the racket. Ultimately it is the arm that needs to work efficiently within itself for acceleration to be realized, and I hope I outlined that clearly enough when describing how the arm works to swing laterally around the body. This is the reason why you see players with great forehands so "open" facing the net after the hit. It has been the acceleration of the stroke (arm) itself that has pulled the body around like this and not the other way around. It's not about the body turning (rotating) around "and pulling the racket arm along," which is often stated.



# Revolutionary Tennis

## Tennis Instruction That Makes Sense

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### Grand Unification Theory: the tennis stance

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mark@revolutionarytennis.com

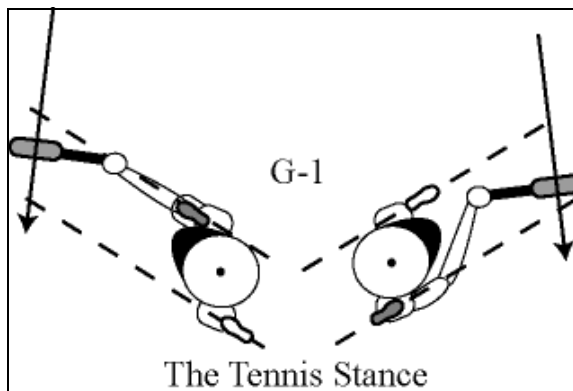
There exists the concept of perfect tennis form, and this happens when you hit the ball "just right." That is for the most part prior to contact you moved forward into the ball just right, Step 1, at contact your feet were just right to one another and to the ball's flight line, Step 2, you were neither sideways nor open to the ball at contact and linear momentum from the body empowered the swing, not angular momentum, Step 4. (And you hit the ball on time.) Doing things just right, then, finds you in the Tennis Stance, a fixed relationship of the feet and body and weight shift into the ball at contact.

The configuration of the arm at contact is discussed in the Step pertaining to the stroke and not here, and body weight shift is found in Step 4. The big picture here belongs to the feet, the body, and their relationship to the angle of the ball that moves away from you.

By understanding the Tennis Stance you will be able to strengthen your weakest stroke. You'll be able to understand why something isn't working right and you'll be able to do something about it beyond what's been discussed in other Steps. **Revolutionary Tennis** breaks new ground here.

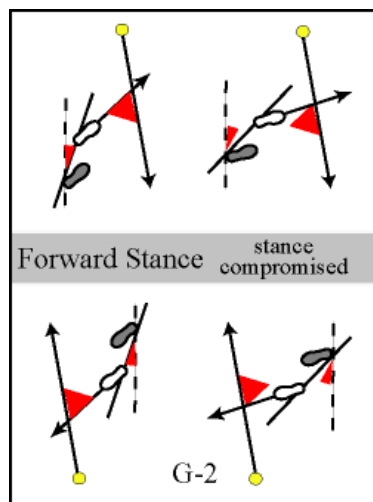
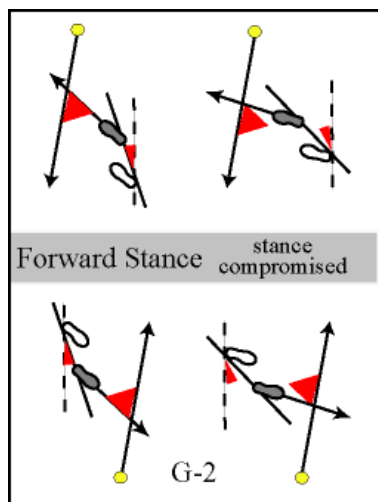
### THE TENNIS STANCE

The incoming angle of the ball's flight line has everything to do with achieving the Tennis Stance because it predetermines the direction in which to move and how the feet, the body, and the racket will line up. Diagram G-1 shows the Tennis Stance. The ball hit in this example has been struck from the behind the middle of the opponent's baseline, and the player was able to move forward easily. Both feet are pointing at the ball and you step into it for contact with the front foot, Step 2, the racket is at a right angle to the ball's flight line to hit through the middle of the ball, Step 6, and the hitting zone between the width of the feet is defined by the dotted lines extended from the feet, Step 3.



If this looks familiar to you it's because the feet are in the Forward Stance, Step 3, and this forms the foundation to the Tennis Stance. The Tennis Stance is the Forward Stance linked on a particular angle to the angle of the ball: you're not stretching, you're not too close, you're "just right."

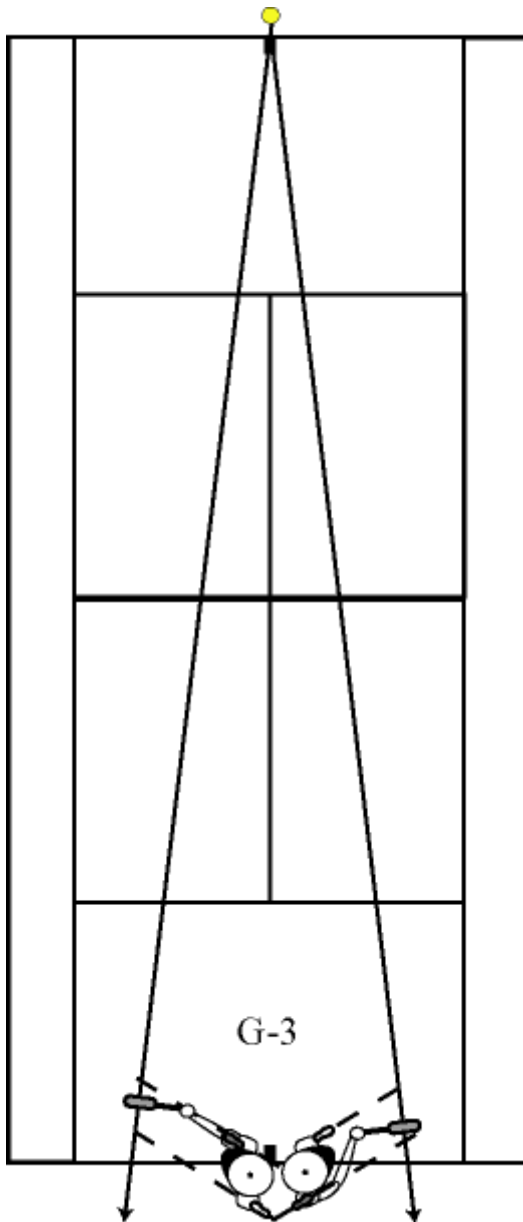
The particular angle at which the Forward Stance is linked with the angle of the ball is shown in diagram G-2. G-2 compares the relationship of a right hander's forehand feet to each other, and their relationship to the angle of the ball. The bottom half is merely a flipped version of the top half, and I did it because you often see pros from this perspective. The red areas represent the angles involved, and the dotted line goes all the way up to the opponent's contact spot, representing the zero degree baseline.



In the Forward Stance, G-2 left top, both feet have been moving into the ball's angle per Step 1. Here the feet are not spread that far apart from each other when viewed from above.

However, if you step across, shown in G-2 right, top and bottom, the feet no longer are moving into the ball's angle. Here the feet spread apart too much and the Forward Stance is compromised.

## "JUST RIGHT"



When the angle of the ball changes, the Tennis Stance remains the same with respect to the ball but your perspective with the court changes. This change is responsible for being able to hit “just right” under any circumstance: returning deep balls into your corner, down the line, hitting inside out, returning serve, volleys. Let me show you how this works.

G-3 is a full court view of G-1 to hit “just right.” The court is drawn to scale, but the player is not so you can see things better. I should have placed the little player closer to the center for contact, but I wouldn't have been able to fit both backhand and forehand in one diagram.

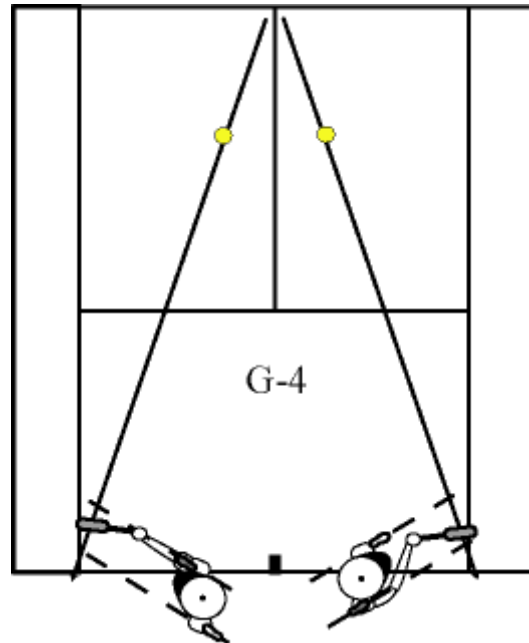
In G-3 the angle of the ball represents a “simple” rally that is familiar to you. It's an easy ball that started from the middle of the opponent's court, the court lies straight ahead of you, you move forward into the ball, and contact is made when it's neither too close nor too far away. Just right.

But of course not every rally is of the easy, normal kind. More often than not you're dealing with a ball hit crosscourt against you or down your sideline. How, then, do you change your perspective on the court in order to maintain the Tennis Stance?

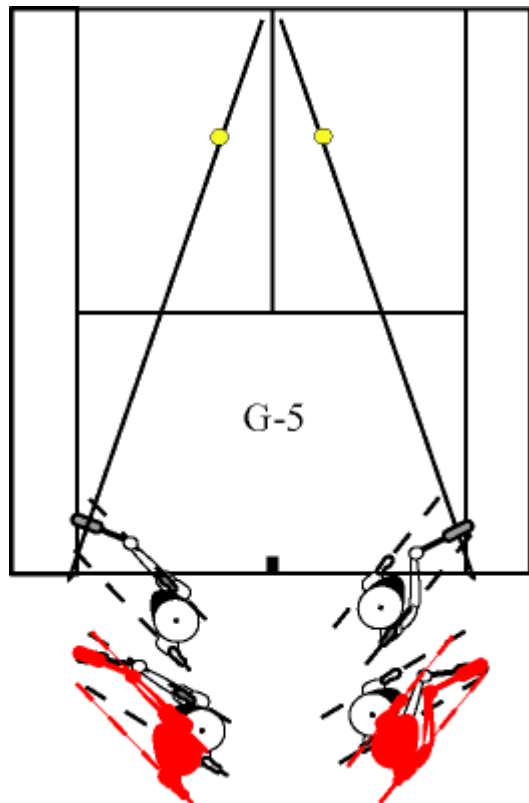
## ANGULAR PERSPECTIVE

Diagram G-4 is different than G-3. Here the ball is struck from the opponent's corner, not from the middle, and it goes crosscourt to your own corner, not close to your own middle. But while the angle of the incoming ball in G-4 is different than in G-3, the player remains the same with respect to the court as in G-3.

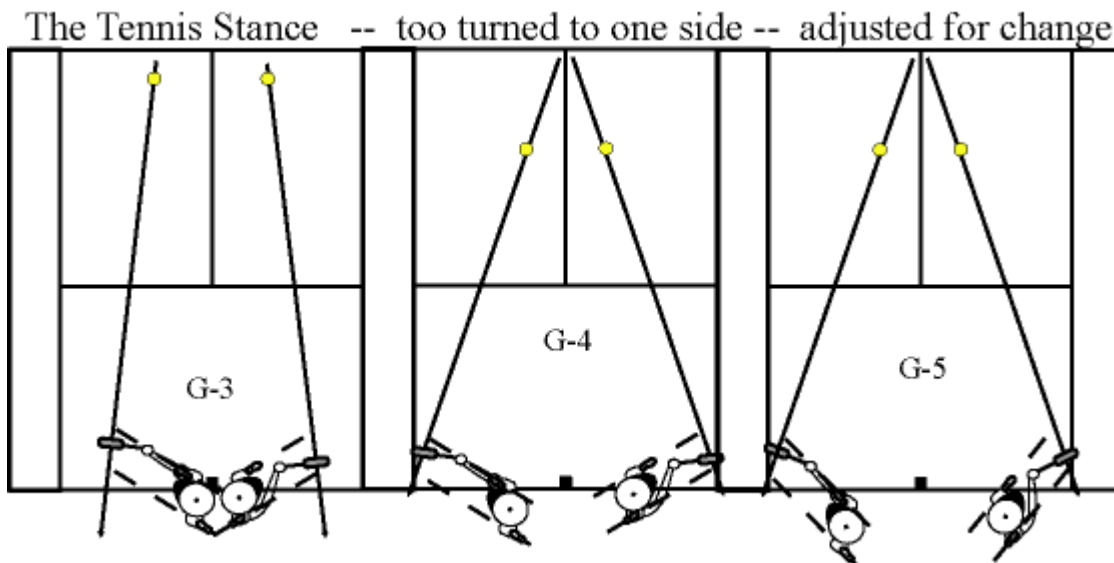
G-4 does not replicate the Tennis Stance (G-1 and G-3) because relative to the ball's flight line the feet and body are turned too much to the side (and the racket face is not at a right angle to the ball's flight line). The difference is slight and not easy to see, but I'll soon overlap the two. Yes it's true you could make contact earlier to be at a right angle to the flight line, and that would help a lot, but the point is here your body is not optimally aligned with the ball (the Tennis Stance) as it was when hitting "just right" in the "simple" rally in the earlier examples.



In order to reproduce the "just right" Tennis Stance for diagram G-4, we go to diagram G-5. In G-5 the player's alignment with the ball's flight line now matches what was in G-1 and G-3. I picked up and turned the player on the left slightly clockwise (and the player on the right counter clockwise) to reproduce the Tennis Stance from G-1 and G-3 because the angle of the ball changed. The readjustment leaves the player more "open" to the net than before, yet s/he is hitting and lining up with the ball "just right" under the "normal" rally as in G-1,3. What has changed is the player's perspective on the court.

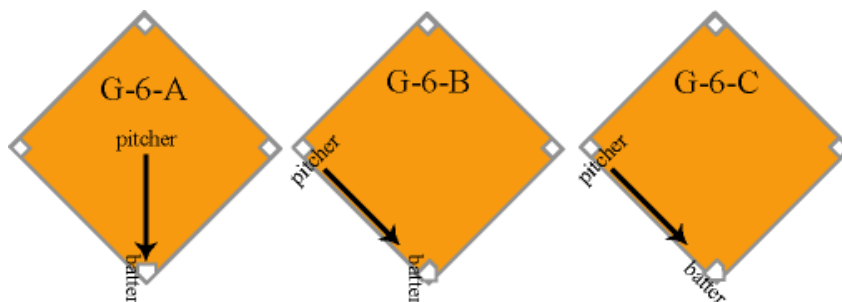


Below G-5 I superimposed the readjusted Tennis Stance (in red) over the G-4 stance that is too turned to one side (in black).



## BATTER UP

Baseball offers a clarifying perspective. Say you're at home plate, diagram G-6-A, in the batter's stance, sideways, one foot ahead of the other, and the pitcher is straight away to the left side of your body. The batting stance is the player's alignment to hit a baseball thrown over home plate. But what if the pitcher decided to move to third base before pitching to you, what would you do? Would you remain in your stance, G-6-B, and be too turned to the side to handle the ball well, or would you readjust your stance to maintain your alignment with the ball thrown at you, G-6-C? The answer is you'd readjust.



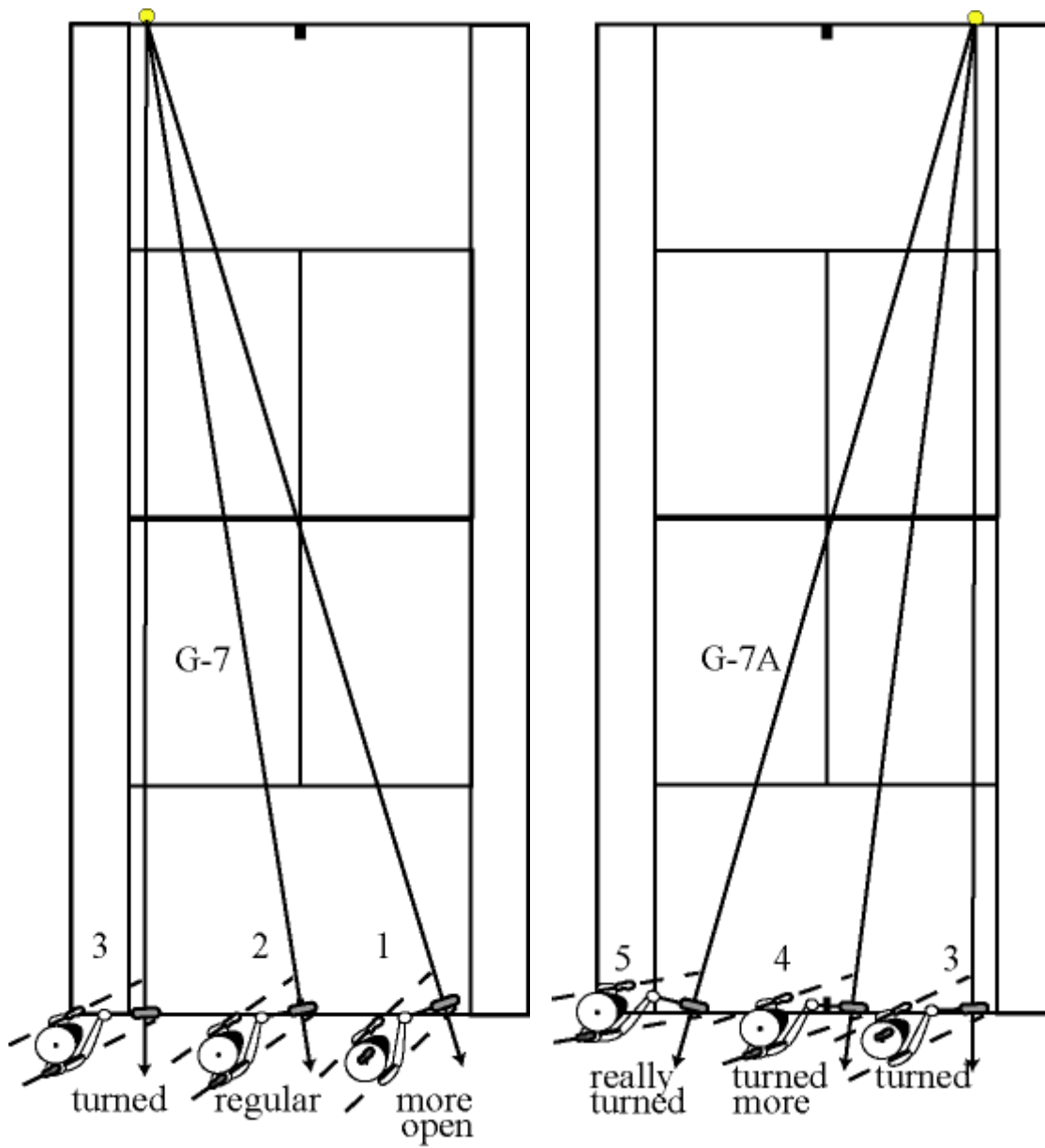
Yes, some baseball players open or close their stance, but it's safe to say the batting stance reflects a particular angle of the feet and body with respect to flight path of the incoming ball.

## GRAND UNIFICATION THEORY

Diagrams G-7 and G-8 unlock the hidden richness to your game. They show how to change your perspective on the court to maintain the Tennis Stance as the angle of the ball changes.

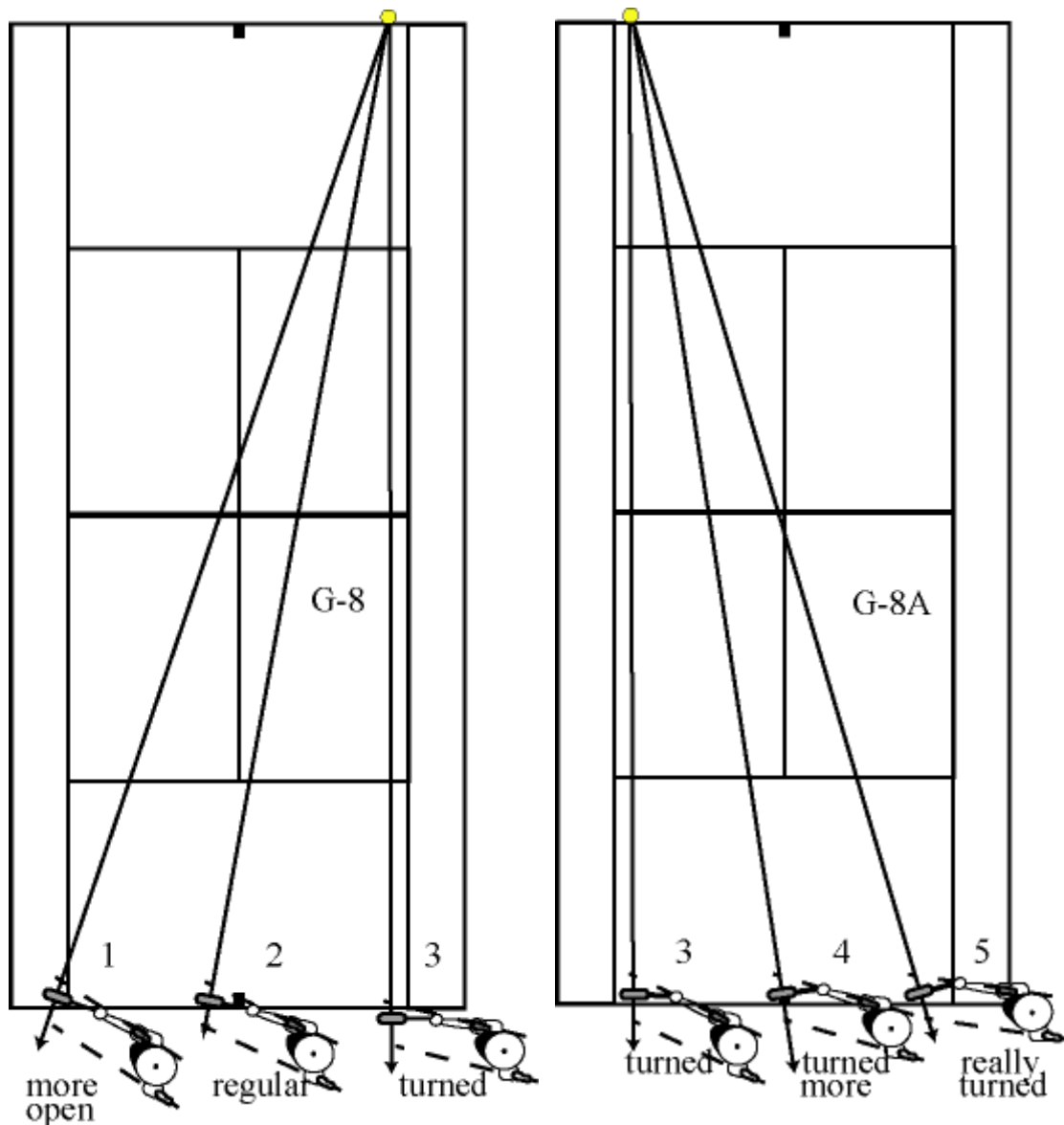
Let's get our bearing straight here first. The descriptions “more open, regular, turned, turned more, really turned” are depictions of your perspective with regard to the court. Depending on where the ball is coming from, to execute the Tennis Stance you run the gamut of being really turned with regard to the court, position number 5, to being more open to it, number 1.





G-7 and G-8 help explain how to position yourself to return balls hit crosscourt into your backhand corner, how to position yourself when running around your backhand to hit inside out, how to position yourself when returning serve for singles or doubles. Even though all positions are aligned equally with the ball and are “just right,” you are most comfortable with position number 2, “regular,” because you are neither turned too much nor too little with regard to the court ahead of you. You have to get used to being more turned and less turned.

G-7 and G-8 act as troubleshooting diagrams. As an example, how do you achieve the Tennis Stance for a ball hit crosscourt against you to your backhand corner? G-8, position number 1, shows the position of the Tennis Stance with regard to the court. It is the “more open” position. Unfortunately, the tennis establishment often advises you “turn” or “turn more” to deal with the ball crosscourt into your backhand corner, positions number 3 in G-8, or number 4 in G-8A. This is like our baseball batter in the G-6-B example not adjusting when the pitcher moved over to third base to pitch. Your alignment is so out of whack the only chance you’ve got to get a good shot off is a lucky one.



Time and time again students diligently “turn” when a ball goes crosscourt to their backhand, and time and time again the resulting shot is weak. “You are over-turned,” I say to the student. “Open up with respect to the net and you’ll be aligned properly with the ball.” I love watching the smile that follows their solid crosscourt return to my own backhand.

## HOW TO GET THERE FROM HERE

How do you wind up in the Tennis Stance if the angle of the ball is different every single time?

Footwork. Better yet, your footwork changes with regard to the court, just like the Tennis Stance. It's perspective again.

Diagram G-9 shows G-3 but with just the feet, where the opponent's contact was behind the middle of the baseline. Per Step 1, the 90 degree mark determines whether you're moving into the ball or away with the ball, and the curved arrows represent in broad and general form the direction of movement into the ball. The actual direction of the feet here is unimportant, they are merely illustrative to serve a purpose, and their scale and placement are decidedly inexact.

From Step 2 you know that to remain in the middle of that angle of possibilities you need to reposition yourself either to the right or left of the center hashmark. It is extremely rare the ball is hit at you literally from the middle of your opponent's baseline.

To see how the perspective of your footwork moving forward into the ball changes with regard to the court, move the opponent's contact spot from G-9 over to the corner. You're left with diagrams G-10 and G-11.

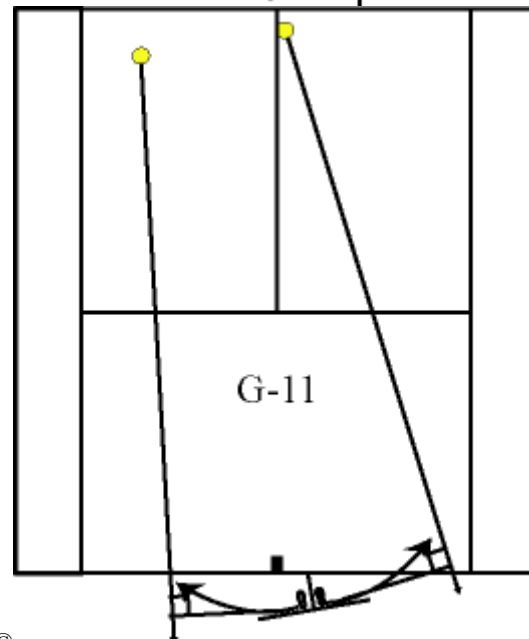
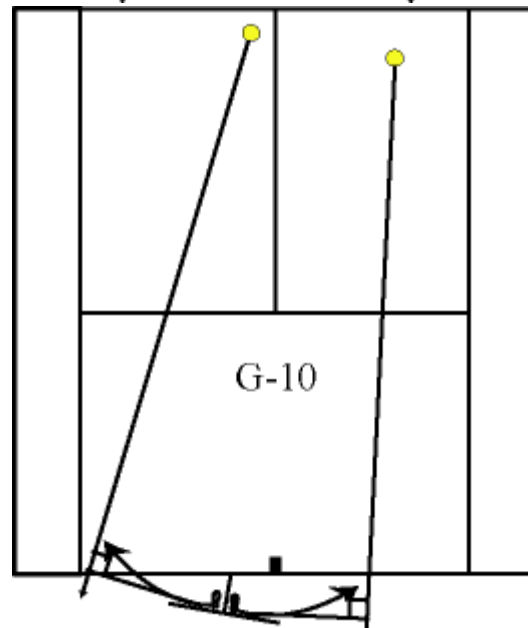
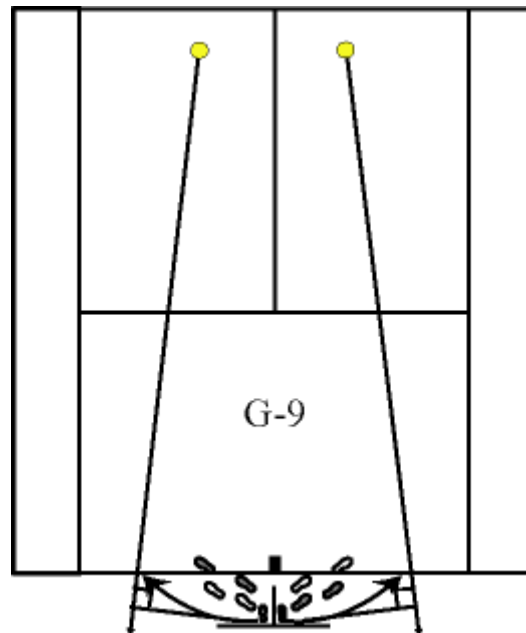
**Movement.** You no longer are facing the rectangular court head on, so instead of moving forward into the court in equal measures either to the left or right it's going to be lopsided.

Responding to the ball hit crosscourt against you, you need to move more inward toward the baseline (and at times inside it) to ensure moving forward into the ball.

Moving towards the baseline here is difficult to do when the ball is perfectly deep, yes, but it's possible when your ready position begins five feet behind the baseline (the pros do). A deeper ready position than the one in shown in G-10 and G-11 (two and a half feet) pulls that right angle mark farther back and behind the baseline, giving you more room with which to move into the ball. Maybe now it's clearer how hitting deep into the opposite corner makes it more difficult for your opponent to move forward into the ball.

Players often respond to the opponent's crosscourt shot by turning with respect to the court and net and moving parallel to the baseline, but the geometry clearly shows in this direction you're turning too much to the side and not moving into the ball. Turning and moving parallel here only makes it more difficult, if not impossible, for you to align your feet and body correctly with the ball. A weak shot follows.

Responding to the ball hit down the far sideline against you, moving forward into the ball means moving behind the baseline or even parallel to it. Too often players equate moving into the ball with



getting inside the baseline, but that's not the case here unless the ball is really short. Since this shot by your opponent can get by you faster (it travels less distance), the upside is you're giving yourself more time to deal with it by moving behind the baseline rather than inside it.

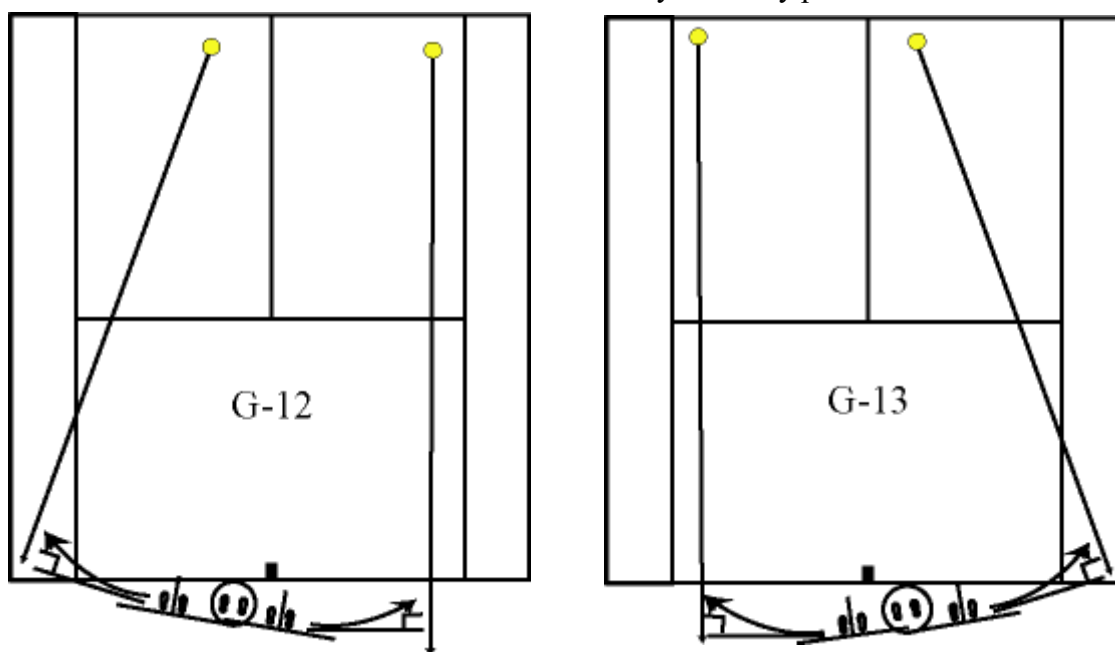
This angular perspective defines how to move into the ball on volleys and returns of serve, and will be outlined in their respective Step.

## THE EXTREME SHOTS

So far the angle involved in the diagrams has been a reasonable one, not an extreme one you may encounter on occasion. An extreme angle means the ball goes crosscourt more sharply, or hugs the sideline more (2 feet from the sideline in the following diagrams). If you try to take 4 steps on groundstrokes with these extreme shots you wind up turning sideways to the ball instead of moving into the ball. And then you think, "if only I could have started over closer to the ball maybe I could have moved into it instead of turning over sideways." You're right, you translate your ready position over a little to that one side before executing your 4 step footwork pattern. Here's how.

To

translate your ready position over to the one side



you take a quick 2 step sidestep. Diagrams G-12 and G-13 show this effect. The circle with the feet represents your initial ready position, and the second ready position with the feet represents what's happened after taking the 2 step sidestep to one side or the other. Once accomplished, you can move into the ball with your 4 step footwork pattern or at the least avoid turning sideways. Of course, you know this takes extra effort.

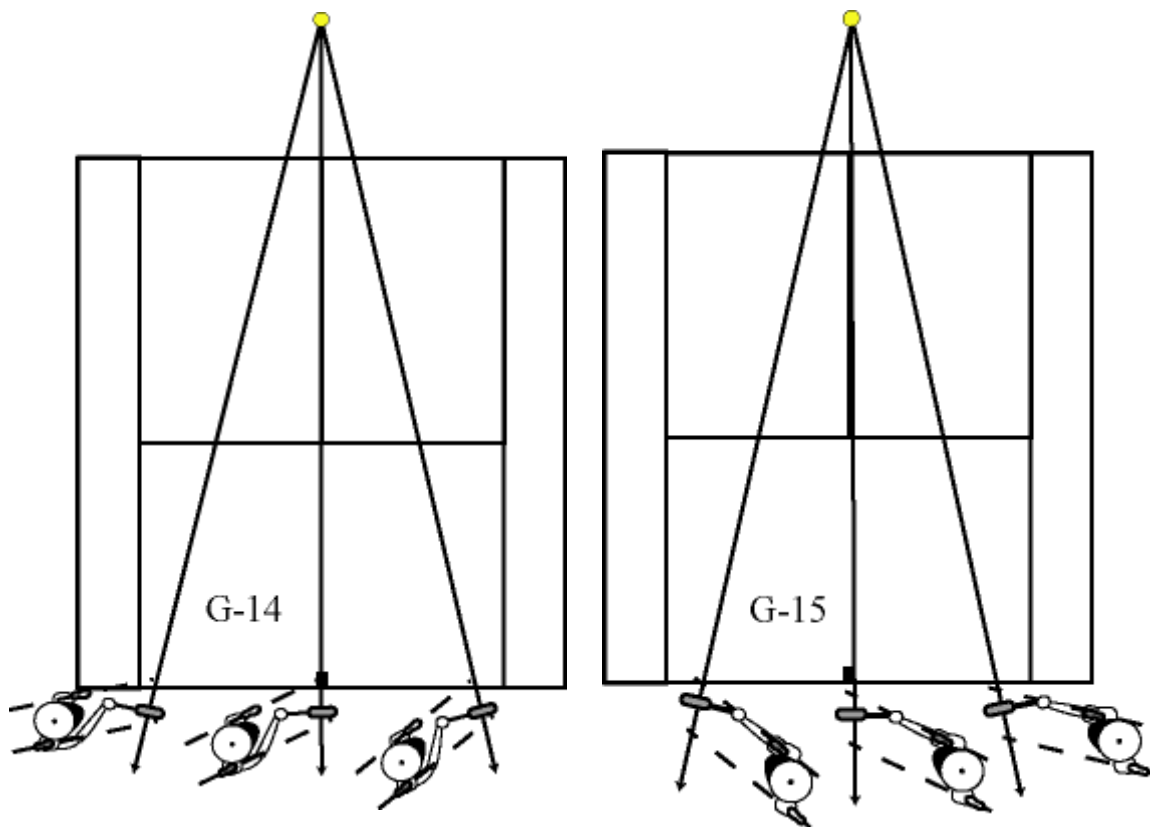
This is the only time sidestepping as part of your movement toward the ball is required, to get your ready position over a bit with regard to the ball so you can arc into it. This is an exception to **Revolutionary Tennis'** 4-step general movement pattern due to the extreme situation, though it's still an even number of steps. Remember, the tennis establishment wants you to sidestep, sidestep, step forward (to the net or the target) and hit as your general movement pattern. This casserole of a footwork pattern not only in part tries to promote the exception as the rule, but as shown in Step 2 this pattern is arrhythmic, covers ground inefficiently, promotes imbalance,

promotes an open stance, and sends you and your momentum off to the side instead of into the ball.

You have also heard and read that your front foot on your backhand should step toward the net post on that same side. This advice works only when the ball is coming at one particular angle, but since tennis reality finds the ball constantly flying across the court at a different angle, the front foot is always stepping differently on the court. The front foot is always stepping at and into the ever-changing-angled ball. Thus a reference point on the court can not serve for any aspect of the game since they are fixed, like a dance floor, while the ball, and you, constantly dance together.

## DRILLS, CLINICS, CAMPS

The most popular drill at camps and clinics is where the feeder stands up at the net and feeds a series of balls to a student at the baseline who runs across the court. Sadly, this kind of arrangement where the student runs parallel to the baseline does not reinforce the idea that there is a relationship between the student's angle of approach into the ball with regard to the ball's flight angle with the student. The result is you're not practicing the Tennis Stance, you're not strengthening the muscle memory at the foundational level responsible for success.



Diagrams G-14 and G-15 illustrate how your stance needs to adjust per the ball's angle when a player feeds you the ball from the middle of the court up at the net (or from anywhere for that matter). As you can see, it's definitely not a case of blindly running parallel to the baseline, or of turning and stepping in the same fashion for all three balls. If you can not avoid this drill altogether, the solution is to start a good five feet behind the line and be really turned for the first ball, move inward inside the baseline for the second one, and then continue arcing inward for the



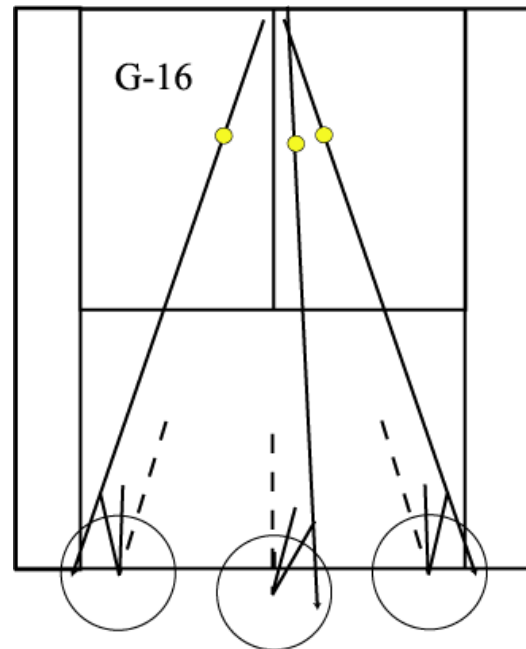
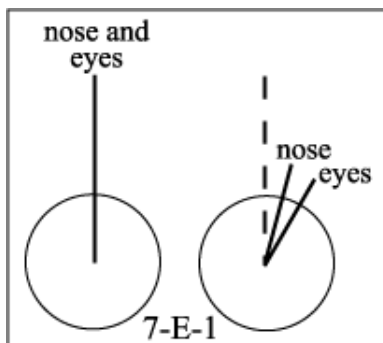
third ball. Of course the feeder has to cooperate, each ball being successfully shorter.

If the feeder hits the last ball deep into your corner, you're being asked to hit on the run, which is okay to run your behind off. But if you want to learn how to handle that tough ball in a real rally, you'll need to assume the body and feet angle from the “more open” position of diagrams 7 and 8 above, which is basically impossible to do in this drill unless the feeder waits for you to square up and sidestep past the center mark before feeding the ball and then asking you to move into it appropriately.

### **”IT'S THE BALL, STUPID,” by unknown tennis bum**

You reposition with, you move forward into, you angle into with, you shift your weight into, you swing head-on into, THE BALL.

And don't forget how to watch the ball from Step 7. The angle with which your head turns to track the ball and the direction in which the eyes look to see the ball at contact also adjust with regard to the court's perspective, diagram G-16. Your head and contact spot might be more turned, or more open to the court than you're used to but you are keying on the ball, per the angle of its flight line.



The Grand Unification Theory adds more elegance to an already elegant game. Play within this elegance and your tennis friends will be envious.

# Revolutionary Tennis

## Tennis Instruction That Makes Sense

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### HEAD ON

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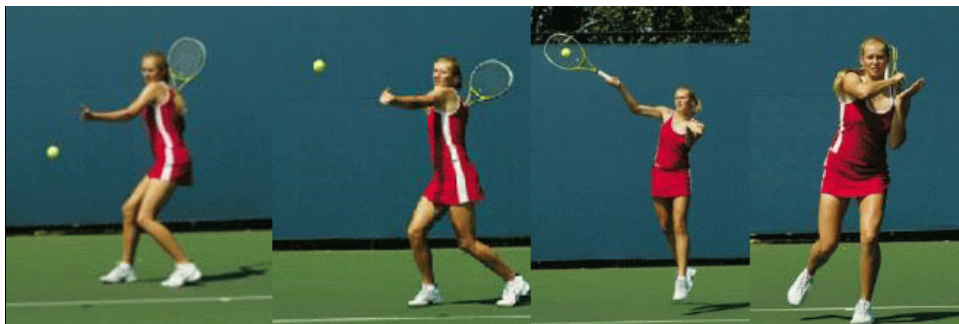
#### THE FOREHAND: OPEN STANCE AND HIP ROTATION

Two TENNIS magazine articles here explaining how to better hit a high forehand and sitter. The establishment teaches as the basic form an open stance forehand and body rotation, and all teaching articles build from those beliefs. Let's see if we are seeing what they are saying.

First a small excerpt from TENNIS magazine's March, 2004 issue: **HARD TO HANDLE: HIGH FOREHANDS, HITTING HIGH FOREHANDS CAN BE A TALL ORDER. HERE ARE FIVE ADJUSTMENTS THAT WILL HELP**, by Curly Davis. Only one of the five adjustments addresses the body's structure and footwork. [Photos by Chris Trotman/Getty Images.]

#### #2. Employ an open stance

"An open stance allows the non-racquet side of the body to clear out during the swing for an unrestricted finish. Your hips and lower body can also easily rotate into the shot, giving it more power. This added arm freedom will help you handle a shot at your shoulders. To get into an open stance, line up the ball with your back foot so that it, and not your lead foot, is closer to the point of contact. Load your weight onto the back leg so you can fire your back hip into the shot." End quote.



It is preferable to remain in an open stance while addressing the high forehand for reasons of rhythm, vision, and timing. But during the girl's forward swing the photos show she does not remain in an open stance. She hits the ball off the front foot.

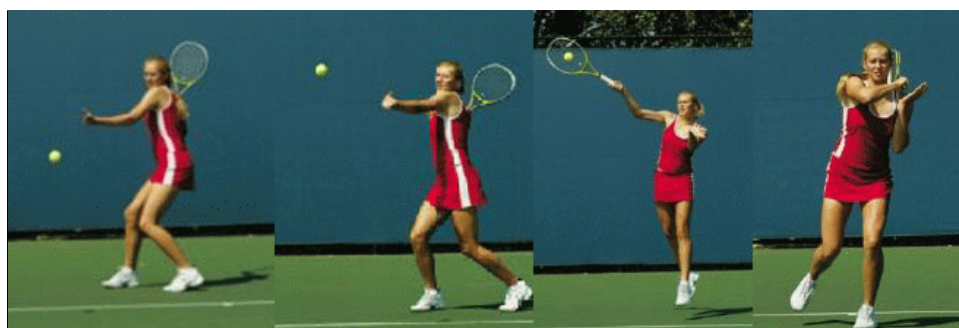
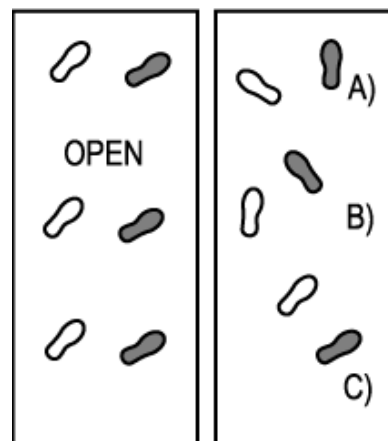
What is an open stance? An open stance finds the back foot closest to the ball during the pre-contact phase, yes, and the front foot a little further out into the court. From this position you can shift your body's weight either by A) rotating on your back leg, B) rotating on the front

leg, or C) moving your front foot forward. A) is a true open stance, that is the body's weight remains on the back leg during the forward swing, body weight can only be shifted via rotation like a golfer and the front leg lifts but does not move forward, at times it winds up going backwards. With B) the front leg acts as a pivot foot, it remains planted and you spin on it so the back leg lifts and comes around and forward. Rotation again. C) is contact off the front foot, no longer an open stance.

In the old days you were told to stand sideways, literally, and take crab-like steps to the ball (but has anything really changed?). The back foot would drag behind you, it was never the closest foot to the ball, the front foot was.

The idea of placing the back foot closest to the ball prior to the forward swing is a good idea instead of dragging it behind you, this speaks to the bipedal footwork pattern seen in Step 2 and applies to all strokes except the serve. From this allegedly "open" position, though, you can take a step forward into the ball with the front foot and thus be hitting off the front foot.

And this is exactly what the photos show in both articles though the writers don't mention it.



In the first photo the girl is in an open stance but her front foot winds up going forward in the photos that follow. She is timing the ball by taking a step forward with the front foot instead of rotating in-place on either foot. Furthermore, linear momentum here is the grandfather of her power structure and not rotation. Yes there's angular momentum, but **Revolutionary Tennis** says linear momentum not only comes first but is the well-house of the body's power delivery system instead of angular momentum, which is stroke related.

In the old days this player would have remained in an open stance while hitting this high forehand or not have left the ground while stepping into the ball with the front foot. Certainly this girl is loading her weight on her back leg, duh!, and she could remain in an open stance during contact but she chooses not to as the ensuing photos clearly show. She steps forward into the ball and times it off the front foot - her front leg is not lifting and moving back during contact, her back leg is not swinging around during contact, both of which would mean and show an open stance contact.

At the end here I will show a photo of Borg's open stance and a sequence by Navratilova for further clarification.

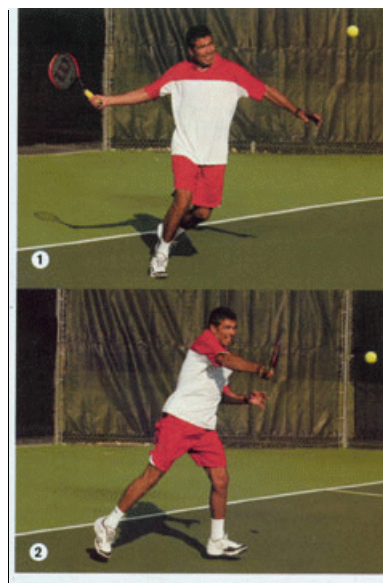
The second article by Juan Nuñez, May 2004, gives excellent advice on how to put away a sitter

[photos by Fred Mullane/Camerawork, USA], and though he talks about footwork his photos show a larger picture of footwork left undiscussed. It reads:

"When you move up to a short ball and you're the right distance from it (1) step forward with your right leg (left if you're a lefty). Make sure you slightly pivot, or turn, your planting foot so that your toes point out. This facilitates your upper-body rotation on the backswing while you load your weight onto your planting leg. Keep your racquet on the side of your body at shoulder level with the head above your cocked hitting wrist. You want to strike the ball at the same level of your take-back; at the same time, your planting leg should be pushing your body toward the ball. Use your wrist to accelerate the racquet and (2) drive the ball toward your target for a winner." End quote.

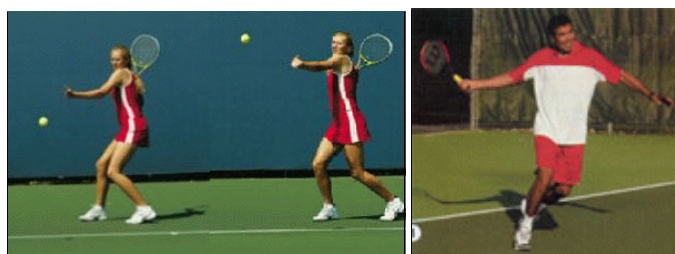
His first photo illustrates how you step forward with the back foot prior to contact and allow the back leg to push your body [forward] toward the ball. All is well and good but again, the second photo shows this is front foot contact and not open stance contact.

Juan's back leg pushes him forward toward the ball and he hits off the front foot, not the back foot. It's front-foot contact and NOT AN OPEN STANCE as may be implied or inferred. This is our (a hitter's) preferred method of timing and power, off the front foot. If the front foot doesn't touch down on the court prior to contact in a more traditional sense that's okay, as long as it was on its way, which is similar to volleys where often you hit the ball before your front foot steps, or touches down, on the court.



Lost in both these examples is the larger picture of what footwork is. Each player takes a step with the back foot and then another with the front foot during the striking routine. This is the 1-2 pattern that defines human footwork for any endeavor as **Revolutionary Tennis** outlines in Step 2.

The 1, or the back foot in the picture, has its toes turned in (as predicted by Step 2 and evidenced below) even though Juan writes "planting your foot so the toes point out." The girl above has her toes pointed out while waiting at the baseline, yet by her second frame the toes are pointed inward, as are her right knee and right hip bone. Turning your toes out is what teaching organizations teach their teachers to teach you, but turning your toes out is for ballet dancers. Tutus for tennis players?



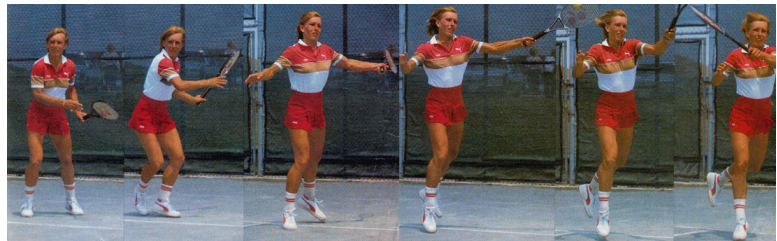
Without further advising that stepping forward with the back foot is part of a 1-and-then-2 footwork plan all of which falls under the umbrella of how to move forward in footwork rhythm, students everywhere will think the above advice is all about the counterproductive ideas of hitting off the back foot and rotating the (back) hip(s). While these two players' hips do rotate (our hips rotate even when walking in a straight line), the two players are launching themselves at and into the ball in a straight line. The stroke is angular and causes rotation, yes, but these players make



their lower bodies go straight at and into the ball before this angularity from the stroke kicks in. Without their lower body's input from linear momentum the upper body's "rotation" would be worthless. Just try standing still and rotating your upper body for some "power."

Everywhere, on tennis courts and in magazines, and at every level, this kind of evidence regarding footwork, rhythm, and movement direction for success can be seen. This success has nothing to do with a unit-turn, open stance, rotation. As repeated throughout **Revolutionary Tennis**, sadly these details which help flesh out the larger picture are overlooked which in turn would make it easier for you to play the game. While Lleyton Hewitt will turn his back foot out to the side as an initial reaction, watch what he does once he goes after the ball. His initial move is no different than an outfielder taking a couple of steps back and over before moving forward to the ball once he gets his bearings straight. Are baseball outfielders instructed to move back first? Of course not, but they have time and real estate tennis players don't.

I include a photo sequence of Martina Navratilova hitting a forehand return from World Tennis magazine. Exactly as opined above in TENNIS magazine, her back foot steps forward and closer to the ball than the front, and exactly as the other photos she launches forward and times the ball off the front foot. Ask her if this is an open stance situation or front foot contact. Anyone out there know her? Ask her.



This photo of Borg shows an open stance. He is loading his weight on his back leg, yes, but when he hit the ball his back foot remained back where it is now for the most part. At times he would do an open Forward Stance, that is taking a tiny step into the ball with the front foot, but mostly he would remain in place and rotate around.





# Revolutionary Tennis

## Tennis Instruction That Makes Sense

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### HEAD ON

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#### THROUGH THE LOOKING GLASS -- F/H OPEN STANCE = INJURY

Here is a good example of tennis world dysfunction that hurts the game. And you thought your struggles were your fault! Doubt no more.

The USPTA (United States Professional Tennis Association, a teaching organization) promotes the open stance and calls it "modern tennis." But the USTA (United States Tennis Association, the national governing body for the sport) warns that an open stance leads to hip injuries. And there's more.

But first the tennis-teaching USPTA promotes and instructs what they call the "modern" forehand to its membership. In their Player Development Program newsletter Volume 3, No. 1, February 2006, "Anatomy of a modern shot," they write, "...We repeatedly use the term "load - explode - and land" to explain the basic mechanics of modern groundstrokes as hit by experienced players. **Loading the outside leg for a groundstroke provides the axis around which the core and arm rotate, generating angular momentum** (see Exhibit II)." [bold type is mine]

Exhibit II above shows Gustavo Kuerten in an open stance inside the baseline on a hard court. A vertical pole representing the axis of rotation is drawn through his back hip and a circle around his waist illustrates rotation.



Next we have the USTA's High Performance Coaching newsletter Vol. 8, No. 2/2006 that warns the open stance causes hip injuries and uses similar photos of Gustavo Kuerten.

## From the USTA. "Hip Injury and the Open Stance Forehand"

### Potential Problem

As Gustavo Kuerten performs an open stance forehand, pay attention to pictures 2-4 as he loads and subsequently hits off the right leg and hip. In the open stance forehand, the muscles and structures spanning the right hip are required to absorb large forces (pictures 1-2). This is followed by explosive concentric contraction of the same muscles (pictures 3 and 4), producing the power that is needed from the first links of the kinetic chain. The forces generated by the legs and trunk are ultimately transferred through the kinetic chain to the upper body. Interestingly, most would argue that this is a properly-executed stroke.

However, even when

performed properly, the loading of the dominant side hip is an inherent characteristic of the open stance forehand and must be considered when preventing and/or treating injuries in the lower body.



### Implications for Injury

The repetitive loading of the right hip in a right-handed player can lead to injury to the hip joint itself as well as the hip's stabilizing structures: the joint capsule, labrum, and the muscles and ligaments that support this joint. Players who repetitively load the hip can develop an injury to these structures, especially when strength imbalances and poor flexibility exist in this region. Research has shown that repetitive tennis play can create loss of motion in the hip joint. Players need excellent strength and flexibility in the hip to execute this shot properly. The exercises and stretches detailed in this newsletter can help prepare the player to handle the loads while decreasing the risk of hip injury [Monster walks, figure 4 stretch]. **END**

Why the incongruity? Do we show you how to hit the stroke one day and who-knows-when later say this method can lead to hip injury unless you're strong and flexible enough? The USTA allegedly shows you "what the pros are doing" and then backpedals to cover its ass. Would they recommend using steroids but caution they can be a health hazard? The USTA must take a stand

on the open stance. They don't because their literature clearly shows they don't understand it, they throw everything at you and the kitchen sink and later tell you to duck.

Next time a "certified" tennis teacher tries to sell you on "loading" for more power with an open stance forehand to "lift your game one level" ask if his/her member organization has gotten around to the exclusions to said technique he's selling you that week, i.e. potential injuries, restrictions, shortcomings.

Finally, to show you the lack of cojones in the USTA and in the major celebrity teaching voices, I point you to TENNIS magazine's latest how-to from Eliot Teltscher as he looks at top ten touring pro Nikolay Davydenko's forehand. Eliot, a former top ten player himself and now former Director of Player Development at the USTA after this analysis, absolutely loves Niko's forehand shown as he hits off the front foot.



**Photo 1:** "...With the ball coming right to him, there's no reason this forehand needs to be hit with an open stance."

**Photo 2:** "...Davydenko's weight has shifted from his back foot to his front...."

**Photo 3:** "In this photo you see even more evidence that Davydenko is exploding up and forward into this shot...."

**Photo 4:** "...And while Davydenko is off the ground, this is a result of his momentum, not because he jumped at the ball, which is something I see a lot of players do in a misguided attempt to get more pace."

[Davydenko photos, TENNIS magazine August 2006, Tommy Hindley / Professional Sport.]

Now I know Eliot has cojones, but he alone can't change the stodgy USTA.

Of special note is how the USTA shows Guga on a clay court and behind the baseline where he's most comfortable and definitely to be emulated, but the tennis-teaching USPTA shows the clay court master not only on a hard court but inside the baseline where he is ill at ease. Clueless.

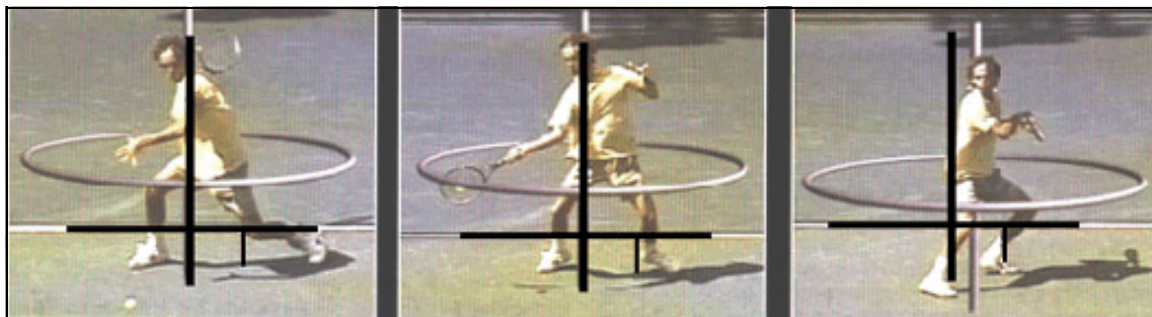
Now here comes the "more" part. Gotta shake your head.



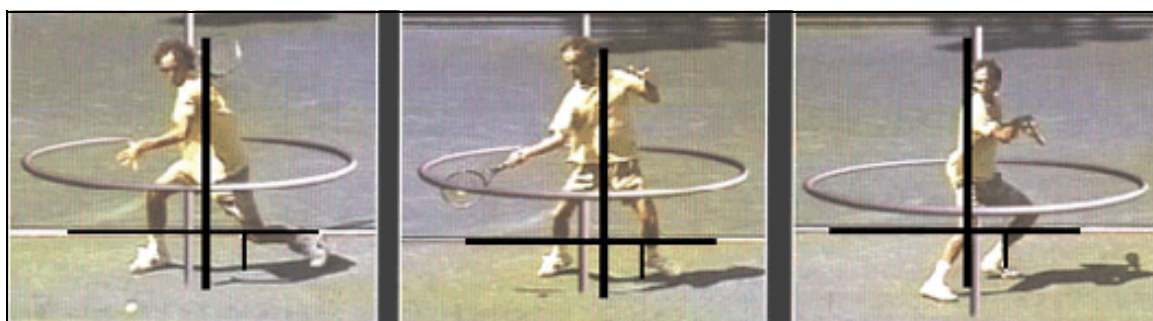
The photos the USPTA uses in their example have been altered to satisfy their thesis. The vertical axis of rotation keeps the same distance from the center hashmark in both photos 1 and 2 (reading left to right), but in photo 3 the axis has been moved closer to the hashmark to line up with Kuerten's back hip after his rotation and thus coincide with their thesis.



You can see the center hashmark in photos 1 and 2 just inside Kuerten's left knee and then left calf muscle. In the photo below a reference mark connects the baseline, the vertical axis, and the hashmark and is shown identically over all three photos. If the USPTA's thesis were accurate the obvious change in photo 3 would not stand out. Shame on them for doctoring the photo.



Why the fudge? Because the USPTA's idea of the rotation occurring at the back hip is incorrect. In the USPTA sequence the outside leg serves as a pivot point, not an axis of rotation, as his two feet on the ground show. This is further borne out by the following photos where the axis of rotation is placed through Kuerten's center, and its placement holds true to the last photo.



If the arm and core "rotate" around an axis defined by the back leg as opined by both the USPTA and USTA then this rotation is by definition imbalanced, and imbalances cause injuries. Why? On one side of this faux axis defined by the back leg you have just the arm in motion during the swing

with a racket in the hand while on the other side of the axis you have at least two-thirds of the body's mass and weight, if not more, pulling at the lesser side. The fact Kuerten spins around and lands on both feet should indicate to the USPTA where the axis of rotation lies.

If the back leg really were to act as an axis of rotation the front leg would remain in the air longer and the player lands on the back leg, as the USTA's photos above illustrate ironically. A good example where one rotates around a single leg/axis is the camel spin in figure skating seen in the photo (caption reads: Carla Korte / flint 4 Seasons FSC), but tennis players never really look like this.



Perhaps the idea of either loading the outside leg or using it as the axis of rotation should be looked at in a more circumspect manner. It is the point of view of **Revolutionary Tennis** that the axis of rotation, when present in the open stance forehand, does not lie through the back leg/hip but instead lies through the body's center.

If the player "loads" on the back leg a re-balancing mechanism needs to take place in order to avoid injuries to the back hip. The re-balancing mechanism is simple, body weight needs to shift onto the front foot. The footwork form for this is the Open Forward Stance promoted on this web site. Its main advocate is Roger Federer (and Agassi, Sampras, and others).



The Federer photos are from the USTA's High-Performance Newsletter Vol. 6, No. 4/2004. The first series is a serve return, the other two groundies in play. There is a concerted effort not to spin on one leg or rotate like Kuerten's example. Federer also has more footwork looks: he does rotate on his back leg and lands on his back leg, he does spin around in a quarter circle transposing back foot to the front and vice versa. But for the majority of his forehands he chooses to put the front foot in there somehow, he lands on it.

When the USTA says: "However, even when performed properly, the loading of the dominant side hip is an inherent characteristic of the open stance forehand and must be considered when



preventing and/or treating injuries in the lower body," it is not the loading that must be considered but **its release form**. Loading on the back foot only to explode into the shot and land or remain on the back foot as shown in both Kuerten examples above leads to hip injury. No amount of flexibility or strength would abrogate this reality. Exploding onto the front foot in one manner or another mitigates this concern. One always loads, it is the unloading process the USTA and others need to look into first to help prevent injury and help you play tennis better, not the open stance. How much loading is considered necessary or realistic is another area to dissect. And what is more important, the loading or unloading? And aren't we already loading when moving to the ball?

This reminds me of how all the tennis books advocated extending the stroking arm straight out as far away from the body as possible to increase power since in physics the longer the lever the greater the torque for more power in your stroke. Even for two handed backhands. This is slowly being retracted since it does not apply to tennis. We want acceleration, speed, repetition. The same awareness will eventually happen with this loading, exploding, body rotation thing. While in principle rotating the body and unwinding the kinetic chain results in most power, its use does not translate effectively to the reality tennis encompasses.

The best way to avoid this potential hip injury is to hit off the front foot. Now why is this so difficult to say, why don't we teach this as the bread-and-butter to terrific tennis technique? The open stance is not the overarching technique that leads to terrific tennis. It is a sidebar.

## ADVICE

The forehand open stance where you rotate solely on the back leg and are unable to step onto the front foot first after contact is a counter measure stroke needed in the tennis player's arsenal. This stroke is a defensive stroke though it can be hit with power. But do not be confused with the apparent power, repeated use of this back-leg-only shot wrecks the hip joint and should be avoided in favor of striking the ball with better composition that offers less potential for injury. Getting to the ball early to set up, load, and explode while only on the back leg is a good effort wasted. Instead by all means plan to use your front foot for a better shot.

Use the open stance forehand if you are late reaching the ball or are quickly rushed, if you have a habit of stepping across the ball's flight line too much, if you have difficulty seeing the ball well or need to buy some time, or if you just can't get the hang of easily stepping into the ball with the front foot. But don't use the open stance to load and unload for power, the Forward Stance and Open Forward Stance already allow for that and with fewer headaches.

Less is more. Though often not with my verbiage, my apologies.

FYI: David T. Porter, Ed.D., USPTA Education Committee chair, chose the Kuerten illustration for the newsletter, and Paul Roetert, Ph.D., the managing director of player development for USTA who also represents the USTA High Performance Coaching Program, vetted it before publication.

# Revolutionary Tennis

## Tennis Instruction That Makes Sense

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### MODERN TENNIS NOT

#### Part 1

### Move Forward and Step-And-Hit With The Semi-Open and Open Stance

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The open stance era is now deeply embedded in professional tennis and in the tennis teaching world. Proponents of the "modern" game want you to coil the body first to "load" muscle body-power via the "kinetic chain," and then uncoil or unload it by rotating the hips and shoulders for power. Selling terms are "load, explode, and land," "modern tennis," "more racket acceleration for power," "play like the pros." It's no longer move forward into the ball, step-and-hit, right?

How many of you, when trying the "modern" forehand, feel you're working too hard for the shot you're getting? Or wonder why you're not hitting a heavier ball or why something's off but you don't know what it is? Or, ironically, you feel a lack of power? All this means a basic fundamental is missing somewhere.

#### **THE SINGULAR FUNDAMENTAL: NOT IN THE OPEN STANCE?**

You are told to "work on your fundamentals" in any sport when your timing and rhythm are off, symptoms of which are your game's flat, things are off, it doesn't feel right. To get your feel back you return to something basic, something very simple you learned from day 1: a singular fundamental for timing and rhythm. Most often in sports the fundamental for timing is step-and-execute off the proper foot - step and throw, step and shoot, step and punch, step and kick, step and jump.

What is a "fundamental" in tennis? Move? Unit turn? Sideways? Load? Racket back? Follow through? Rotate? None of the above. For tennis our singular fundamental is step-and-hit.

A perfect analogy is with baseball. How do they teach little leaguers to throw? To turn, step forward with the front foot, and throw. Tennis is no different. We turn at least the torso or angle the body, step forward with the front foot, and swing. Our timing comes from the front foot taking a step, not by turning, and the rhythm for the stroke comes from shifting body weight.

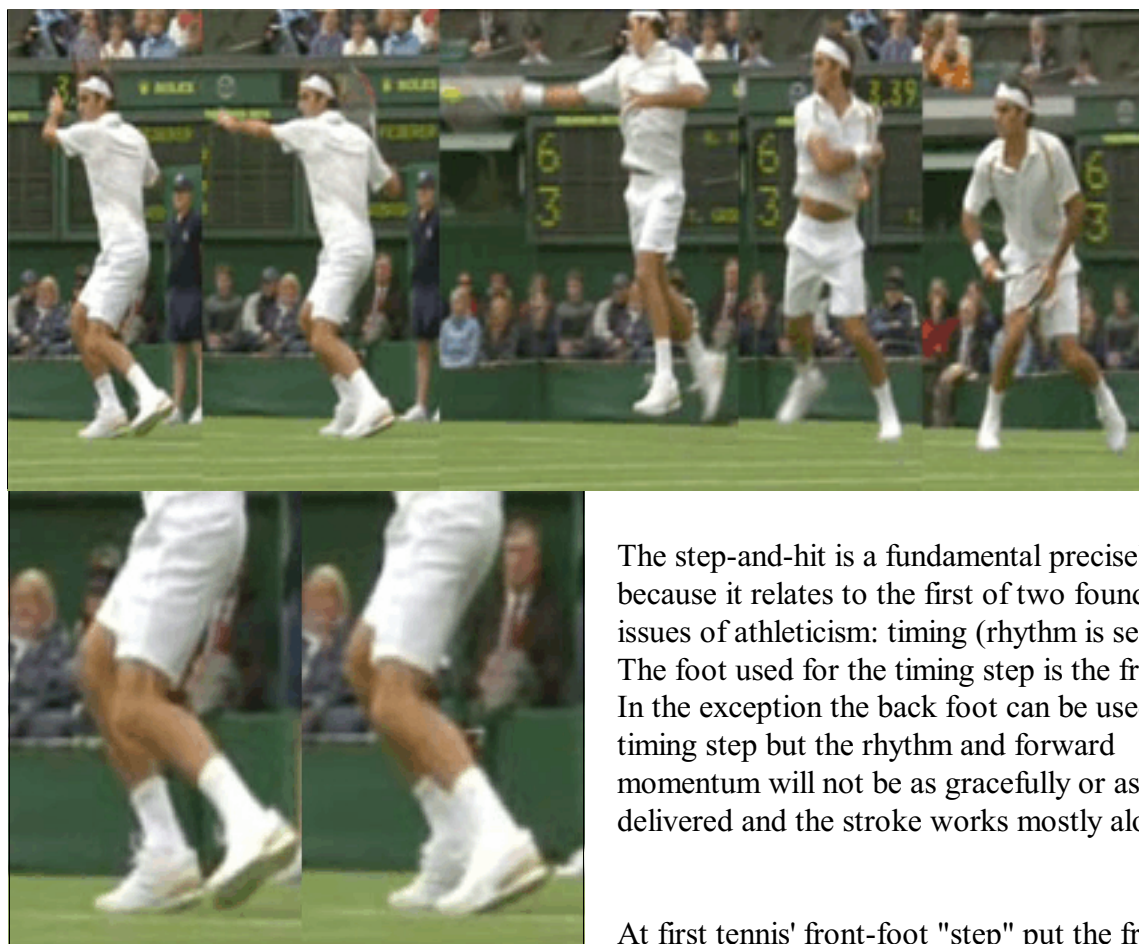
This begs the question, where is the fundamental of step-and-hit in the open stance load/unload scenario? If it's there why isn't it taught, but if it's not there does the open stance offer a new "fundamental" for our game?

It is not a coincidence we value, and see the grace in, the playing style of Federer and Sampras over Rafael Nadal and his fellow dirtballers, and it is not a coincidence this playing style rises to the very top (not to discredit the dramatically open stance players). Common sense says a "fundamental" is the taproot upon which other layers can be added organically, regardless of era. If this holds true the open stance must use the step-and-hit, mustn't it?

The tennis teaching world understands the step-and-hit as stepping forward with the front foot, or even across at times perhaps, to shift your body weight/momentum onto the front foot before swinging, and that you don't step literally the exact moment the racket hits the ball. But what the teaching world has never offered is that the step-and-hit is primarily a timing step and not a step for power: The front foot touches down and the stroke, or the throw as in baseball, occurs.

Garret, a [Revolutionary Tennis](#) reader in Norway (!), sent me some Federer forehands on YouTube to look at asking about the "modern forehand" as it relates to the Forward Stance. One of his clips showed Federer using the singular fundamental of step-and-hit in a semi-open stance, and I found another clip of him showing it from an open stance. Hence this white paper is because of Garret's smart email, I saw something that jumped out and needed mention.

Today's open stance will use the step-and-hit for timing with the front foot if it's indeed a fundamental, but does it? Judge for yourself. With Federer's semi-open stance forehand return his back foot is down on the ground first, "loading," and his front foot is in the air. Then the front foot steps down onto the court - timing step - and the stroke is launched. This is step-and-hit, from a semi-open stance, and he moves forward with it. Federer is not alone in showing us how the singular fundamental has adapted to work with the open stance, he's just the best with it.



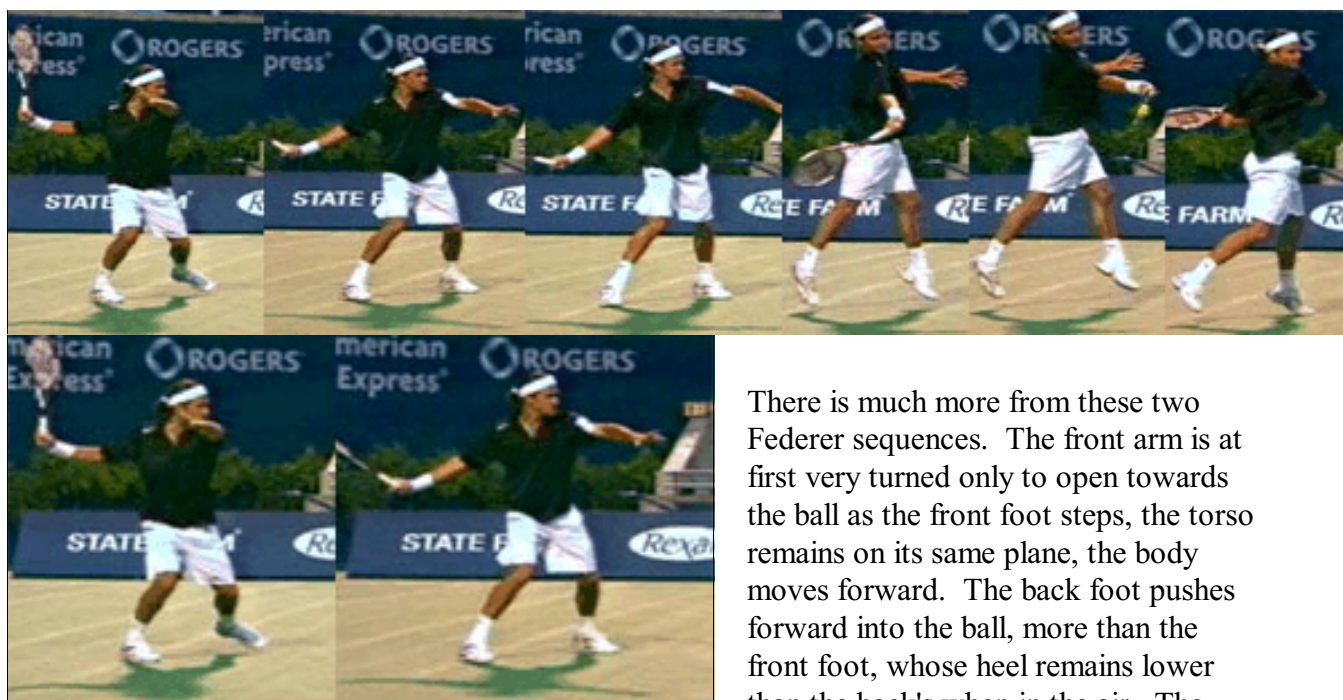
The step-and-hit is a fundamental precisely because it relates to the first of two foundational issues of athleticism: timing (rhythm is second). The foot used for the timing step is the front foot. In the exception the back foot can be used as a timing step but the rhythm and forward momentum will not be as gracefully or as easily delivered and the stroke works mostly alone.

At first tennis' front-foot "step" put the front foot across and sideways (closed stance), then more forward and in-line directly ahead of the still-sideways back foot (neutral/square stance). Today both feet are identically angled, either alongside each other with the front foot slightly ahead or even with the back foot (open/semi-open forward stance), or they are in-line with the front foot forward (forward stance). Regardless of stance, step-and-hit is very much present.

Federer uses the front foot as a timing step in most of his forehands, he often steps prior to the stroke even when he has spun the back foot around. He can adjust and prance the front leg up in the air or transpose the feet like others, but you can consistently find this timing step in his game.

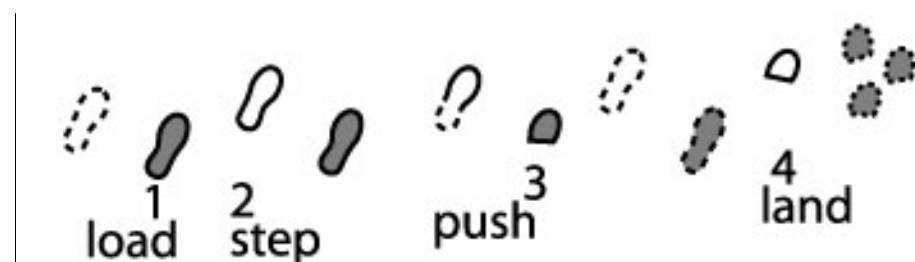
As a larger, more radical theory found throughout **Revolutionary Tennis'** pages, this step-and-hit with the front foot takes advantage of linear momentum, the cornerstone to body-power for a tennis player. As shown by Federer not a lot of it is necessary to empower the stroke, it does not have to be a long step in the old school sense, but it is clear his body as a whole is moving forward into the shot. Angular momentum, from rotation, will always be present, but it is not the wellspring for our empowerment and itself requires linear momentum to be used more effectively. Rotation alone will not make Federer's body move forward (seen with Nadal/Kuerten later).

A second Federer forehand shows the same phenomena but this time from a full open stance. Loading, as it were, on the back foot and with the front foot off the ground, Federer then steps down with the front foot and delivers the stroke while also moving forward before/into the hit as the signage behind him shows. He is showing us the fundamental timing step of the front foot (then hit) at work in the open stance while also moving forward into the shot.



There is much more from these two Federer sequences. The front arm is at first very turned only to open towards the ball as the front foot steps, the torso remains on its same plane, the body moves forward. The back foot pushes forward into the ball, more than the front foot, whose heel remains lower than the back's when in the air. The moment of contact and prior finds the

front foot more in front of the back foot when viewed from the side. The body does but a quarter rotational turn into the shot, far less than open stance devotees instruct, because Federer is moving forward into the ball.



Move to the ball, then load, step, push, land, in semi or open stance. Not the Papas method or "new," forward and step-hit is the mother's milk of tennis.

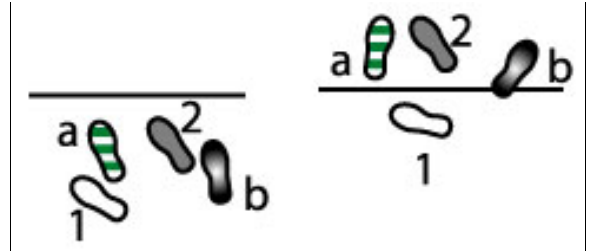




Comparing Nadal's or Kuerten's open stance forehand to Federer's shows a big difference. With them either the front foot prances up in the air when hitting and/or the feet transpose in-place (Kuerten, above, Nadal, right). Neither steps down with the front foot as a timing step nor moves forward into the shot. Instead they load their body weight on their back leg and hip and use it as an "axis around which the core and arm rotate" massively. They move weight/momentum upward and send their back foot forward while the front foot goes backward. It's doable because playing tennis is not brain surgery, but it's a lot more work and their forehands don't hum like Federer's.



I wouldn't want Nadal's forehand, or Kuerten's, but I'll take Federer's. I'll even take Tsonga's open stance, the way he did it while moving forward into the ball when he demolished Nadal in the 2008 Australian Open. Nadal's forehand has a lot of spin, he hits heavy, he's a great player, but he doesn't move forward into the ball nor time it off his front foot. Instead he spins his body in-place to propel his racket and his front foot goes backwards (graphic below his picture).



It's been said the open stance grew out of time/grip/ball height and pace/sideways issues, all true today, and said also in 1926. But the primary reason has been overlooked: injury avoidance, as outlined later in this paper. Combine all of these realities with the step-and-hit used by Federer and what you get is indeed a truly updated forehand. Level-appropriate players can do this and improve, those learning can use it later, assuming both learned to step-and-hit off the front foot.

We teach as "Modern":  
**load** on the back foot  
**explode** to hit, back foot driving up  
**and land** on the back or front foot

Instead we should teach as Updated:  
**load** on the back foot  
**step on the front foot**  
**explode** to hit, *back foot driving forward*  
**and land front foot first**

Learning via the step-and-hit does something to one's proprioception, it speaks to athleticism, timing, rhythm. It allows a student's game to grow and mature because adjustments and variations easily spring from our bread-and-butter.



Federer's forward push off the back foot is how it's been done in the past, it shifts weight forward into the stroke/contact spot. Linear momentum is delivered from the back foot pushing, not the front foot stepping or reaching out to pull it, which is how Federer honors the age-old wisdom of moving forward without taking the long step. The penultimate step is always responsible for so many things: for proximity, for weight loading-cum-transfer/momentum, for stability and strength to support the stroking effort. Federer incorporates this as Budge, Kramer, Gonzalez, Segura, Laver, and Borg did before him, to name but a few, though now we're seeing an adaptation within a new environment, namely a faster game. Question becomes, is this a "modern" or "new" way of hitting the ball, or an update?

Let me give you some quotes from the USPTA's Player Development insert they send their member pros [Vol. 1, #6, 2005, alternate, Vol. 2, #4, 2005]:

"Loading step: the loading step is the final step in the adjustment of the strike-zone setup, and should happen on every shot."

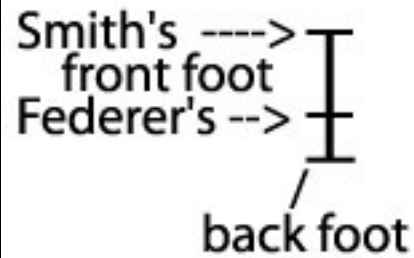
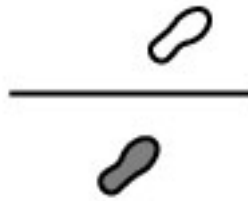
As seen with the Federer examples the "load" step is not the final step but the penultimate one unless braking on the outside leg to hit. The front foot is "the final step in the adjustment" even when held passively out of the way or kept limp up in the air (active adjustment measures).

"Teaching it [turn-step-hit]) as the primary way for players to use their feet during the hitting phase of a forehand is doing an injustice to students."

Perhaps trying to reinvent the wheel is doing an injustice to students. But the USTA says the opposite, from their High-Performance Coaching newsletter Vol. 6, No. 4 / 2004:

"Therefore, as we teach our players the modern forehand, let's not overlook the basics of the square stance [turn-step-hit]. In fact, it may be prudent to still teach this stroke first, especially with younger children."

Stan Smith and his peers used the long last step, photo/graphic right, because that is how they thought to transfer weight/momentum. The graphic below Smith's photo marks the top of Smith's front foot and compares it to the top of Federer's front foot using his graphic above labeled "2 step." The back foot mark is the top of the back foot, common to both. There is a great difference in overall step length of the front foot between them.



Why did Federer shorten this step, due to lack of time, power against him, grip changes? Maybe for all these reasons. Why retain the small step forward, because it's our singular fundamental? Is a small amount of linear momentum material, or has body rotation become the momentum-generating force of choice and Federer's short front step and forward body movement form a prerequisite for this rotation?

Teaching organizations counsel linear momentum is still there in our shotmaking but that angular momentum is the "new" tennis since it takes advantage of the "kinetic chain [that] is the sequential coordination of body segments (feet, legs, hips, trunk, shoulders, arm and wrist) to achieve more force than would be possible if the player omitted any of the segments." I guess they're saying older players never coordinated their body segments.

The confusion lies in attaching the term "linear strokes" with linear momentum, and "angular strokes" with angular momentum. Either way strokes are always angular in nature, not linear like "8 ball, corner pocket." Since the means of delivering linear momentum has been misunderstood it is no wonder its use in today's tennis is overlooked. In fact the long step causes the momentum to dissipate over time and today's version, used by Federer and others, causes a momentum crest like the shoreline causes an ocean wave to rise or break.

These musings and more are the provenance of Part 2. Let's return to why the singular fundamental has been missed in the open stance and how this knowledge can help your game by uncluttering your path to improvement.

If you were to teach your son or daughter how to throw a baseball you would teach them to step forward with the front foot and throw overhand, as seen with the little boy on the near right, and not by throwing off the back foot, taking an extra step with the back foot, or throwing sidearm.



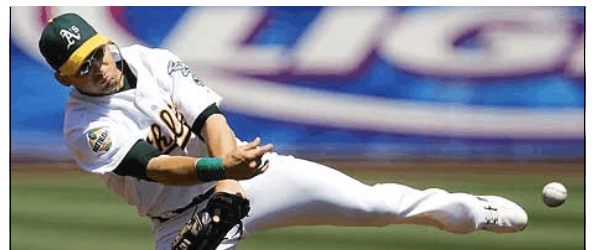
Same for teaching a little one how to play tennis, as shown on the far right. The kid's choking up on an adult racket, using the singular fundamental of step-and-hit, or front foot-contact, and his head's turned off to the side like... That's Federer, by the way, age 3, from the book "The Roger Federer Story," by René Stauffer. Good read.

The step-and-hit is seen in today's open stance forehand though its teaching is absent, and you wonder why. Baseball helps to explain.

Derek Jeter on the right didn't learn how to throw this way, he's adjusting. In baseball you glove the ball and if you have enough time it's not a big deal to set yourself up and throw it. But when time is cut short due to circumstance, which happens often, you get the ball out of your glove and over to the bag no matter how you are, where you are, or what you have to deal with. Under pressure adjustments and variations occur, due to your training.



In baseball you learn to throw stepping forward with the front foot. Over and over again until it's automatic, and then adjustments, adaptations, and variations to suit changing circumstances can occur. When Phil Rizzuto or Ozzie Smith threw off their back foot, or stepped their back foot around and into the throw, or threw sidearm, baseball analysts didn't swoon about a "modern" way to throw a baseball (Venezuelan hot corner man Marco Scutaro, right, in what is not a modern way to throw a baseball).



But for tennis adjustments and variations are called "new," or "modern," or a "new secret method" and you're taught to emulate it directly. We must be smarter than this. If a pro's adjusting or compensating we need to call it just that.



Photographic similarities from tennis and baseball. Baseball coaches do not encourage throwing off the back foot since it leads to throwing inaccuracies and offers less strength (2some left upper left, 4some right upper left). Why, then, does tennis think it's "Modern" when the pros do it? From Dementieva (2some left upper right) to Srichaphan to Roddick to club players (4some right), hitting off the back foot with the front foot off the ground is less effective, just like when throwing a baseball off the back foot with the front foot off the ground. There is a better way.



Baseball players (4some left) as often as possible put the front foot down before the throw, and will stay turned a bit more below the waist even if airborne. Federer strives for this form as well. Front-foot strike, step-and-hit. A fundamental for the ages.

If you are experiencing timing/rhythm problems try the step-and-hit from any stance. If you want to improve your power, try the step-and-hit. You don't have to keep the feet in-line as shown in the Forward Stance, but by stepping with the front foot prior to the swing you create a timing step that feeds your athleticism. Organically.

Truth be told, it's not step and hit, it's step, shift-and-hit. You can step with the front foot yet hold your body weight on the back leg but it feels awkward when you finally shift it forward and swing. Nevertheless the last step is a timing

step because it's giving the green light to the body to shift. You wonder why some swings feel really awkward after you're been waiting for the floater? Because you haven't taken a step just prior to your swing, you've been standing around and your last step was seconds ago.

# Revolutionary Tennis

Tennis Instruction That Makes Sense

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## MODERN TENNIS NOT

### Part 2

## The False Observation Of "Turn-Step-Hit" Throwing The Baby Out With The Bathwater

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The elephant on the court is "Turn-Step-Hit" because it is always presented as the baseline model to compare against what's new and what's different. It is labeled "traditional/classical/foundational" against the current technique called "modern tennis/current game." But the understanding itself of "Turn-Step-Hit" is flawed, it is a technique used for beginners and is not a baseline model. Therefore opinions formed using "Turn-Step-Hit" in comparison arguments will be hollow. Expose this old canard and a unifying form appears regardless of era.

First the definition of "Turn-Step-Hit" from Tennis Magazine's "The Tennis Magazine Primer, A complete guide to the basics of the game":

#### TURN

From the ready position, **coil your trunk** from hips to shoulders as you take the racquet back. Pivot your feet and **shift your weight back**. [the entire quotation]

#### STEP

....**Step forward** [to] target. Let your **forward weight-shift** trigger your forward swing...

#### HIT

...As you **uncoil your trunk** and swing forward....

Second, the definition of "load-explode-land" from the USPTA's Player Development Program, Vol 1., No. 6 / 2005:

"The loading of ["weight primarily on the inside of"] the outside leg ["facilitated by rotation of the shoulders and hips and a knee bend"], the explosion of the shot (especially when hit extremely aggressively), and the landing on the appropriate foot to aid in balance and a quick recovery, are the hallmarks of a more angular style of hitting. The angular hitting style includes several footwork patterns that work in different situations."

A quick look shows no difference. "Coil your trunk" is "Loading is facilitated by rotation of shoulder and hips." "Uncoil your trunk and swing forward" is "Exploding" through the shot. But first let's look at "Turn-Step-Hit."



As a beginner I was taught from the ready position to "turn, pivot, step and hit." I'd "turn" my upper body, "pivot" the (outside) back foot in-place, keep my weight there and turn my back hip, then "step" forward with an angled front foot and "hit." On the right is the 6 photo example of turn-step-hit the USPTA uses as a comparison basis with load-explode-land. (Ironically the upper right photo of the "old" technique is part of the "modern" nomenclature, "unit turn".)

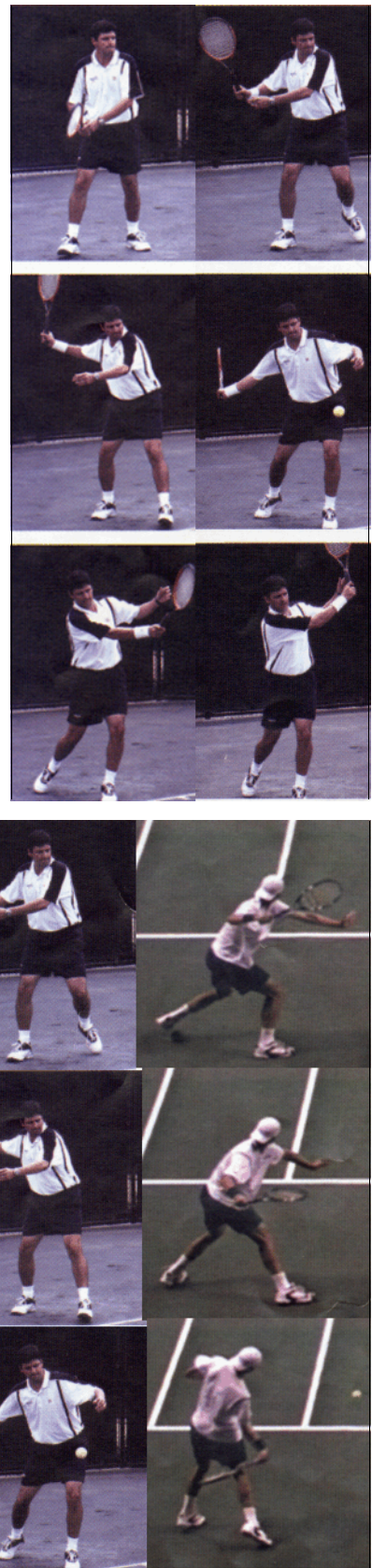
As a junior I noticed players in real-time did not turn-pivot from the ready position because they first moved to the ball, and that before they stepped into the ball to hit their back foot was angled in the "pivot" position. The next-to-last step was "pivot," the last one "step." I figured tennis teaching just did a cut-and-paste job with these last two steps - pivot/step - to teach beginners because it was obvious "turn, pivot, step and hit" wasn't the mantra for real-time technique.

The mantra for real-time technique was "step and hit." You'd run towards the ball, you were turned, your back foot pivoted and carried your body weight, and then it was all about step and hit. "Step-hit" is the baseline model to tennis how-to form, in no small part because it is the singular fundamental. "Turn-Step-Hit" is for beginners. When "new/modern" tennis ideas are held superior or better to "turn-step-hit" it's like a bicycle company noting their modern two wheelers are superior to bicycles with training wheels.

Photos on the right are from the same USPTA's Player Development Program used to show the differences of old and new, but they are similar. The "new" (right column) is shown by a pro in action while the "old" (left column) is shown with a model standing still, as is always the case.

The "load" is seen in both, top left "turn-step-hit," top right "modern" with Roddick. In both the torso is coiled, the weight is on the back leg, the front foot is on toe, the front arm is turned to the side. Energy is stored just as dramatically in "turn-step-hit." The middle photos show step-hit, the heel of the front foot has touched down, though the model steps forward and Roddick does not. "Explode" occurs when the back foot pushes momentum into the ball, witnessed when the back foot's heel is off the ground, bottom two photos.

If the "step" is forward then momentum goes forward into the shot, even with a step in-place. When you push and the body goes off to the side, or spins on its axis and front goes to back and back goes to front, then momentum is not going forward. We want momentum to go forward



into the shot, don't we?

The statement:

"Linear momentum is created by the forward step in a square stance forehand" is false on many fronts (USTA High Performance Coaching Newsletter for Coaches, 2004).

If "linear momentum is created [only] by the forward step from a square stance" it is assuming the forward step is very much out in front or ahead of the back foot. What is being presumed is the player with a long forward step creates a lot of linear momentum (see Smith above) but we have never equated the hardest hitting pro with taking the longest step before hitting.

If "linear momentum is created [only] ...from a square stance" then Federer creating it from both semi and open stances needs to be included.

Linear momentum is created by "the" forward step? The forward step is a timing step, not a momentum-generating step. Linear momentum is created by a forward push from the back foot out of many stances, made easier by "a" forward step with the front foot, no matter its length.

Therefore, linear momentum is created by any length of forward step with the front foot from any kind of stance (and presumably if stepping forward only with the back foot).

In fact Roddick's return showcases bad form, he's been pushing off to his left away from the ball and ends farther behind the baseline for it. His example shows us what we should not be doing though it's showcased for pros' learning by the USPTA and its Education Committee and Player Development Advisory Council. Federer's ad court return clearly shows he has gone forward instead of spinning around on an axis to face an opposite direction. Roddick's example is not of a ball in too close on him, he has taken a large outside step to load because he thinks that is best, and though his front foot is ahead of the back he chooses not to move forward with it because he's been trained to do this massive rotation thing. On the other hand Federer's return is close in on him but he will choose to move forward into the ball. Whose example would you follow?

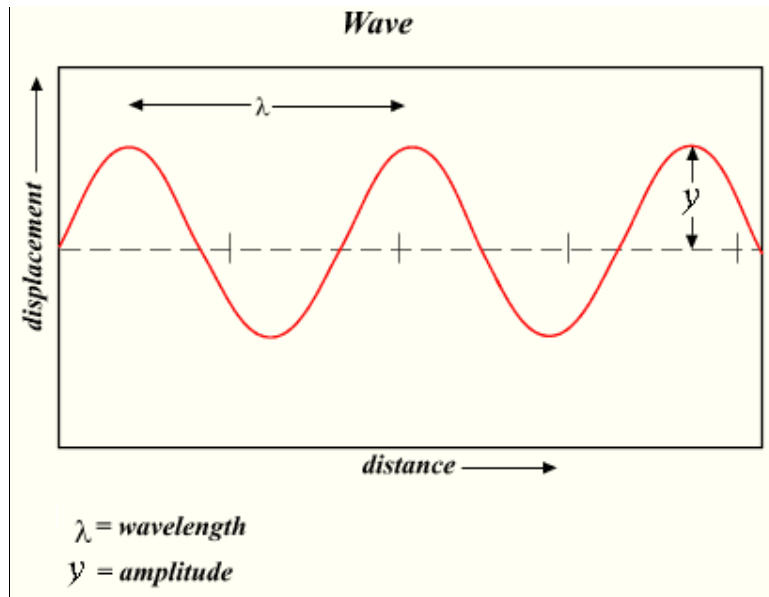


## HOW THIS SHORTER STEP WORKS IN THE STEP-HIT a hypothesis

Ever caught your toe walking on the sidewalk? You know what happens, you're propelled forward, sometimes up and then forward. Your forward movement, or momentum, gets interrupted by what happens at ground level, and, from a layperson's point of view, you become top heavy. Now try this in a controlled manner. Take some normal walking steps and then do a half step while assuming you'd take another step. There is a continuation of momentum.

Walking can be patterned as a series of waves where two steps represent two crests of a wavelength, with a trough and amplitude. If you walk faster the wave on the right becomes more compressed, that is the distance between the crests is less since they happen more frequently. Running increases the crest height, or amplitude.

A tsunami is a series of waves moving along the ocean floor with a lot of energy and a long wavelength to it. It doesn't become the killer wave rising many feet above the ocean surface until its long wavelength is slowed down, interrupted, and compressed by land.



When tennis players "load" on the penultimate foot this is one crest of a wave, the second step with the front foot is the second crest that defines the wavelength. When Stan Smith takes a long step forward to the ball that looks like long wavelength; Federer's shorter forward step is a shorter wavelength. Smith's long wavelength has "X" amplitude; Federer's shorter wavelength has an increased amplitude greater than "X" since he's propelled upward/forward. Roddick's lack of a second step and forward movement leaves him with no other choice than to rotate in-place to generate momentum. He basically muscles the ball over, creating a lot of work.

Federer's short step with the front foot for all the right reasons becomes today's version of (yesterday's) "step into the ball and use forward momentum." The short step, as the second crest to define a short wavelength, interrupts the gait and causes a spike in momentum. But he keeps his balance during this forward-momentum-moment because he's planned for it and pushes hard from the back foot to increase the amplitude as a whole to this wavelength. This is where and how the energy goes forward using a semi-open or open stance in today's faster game.



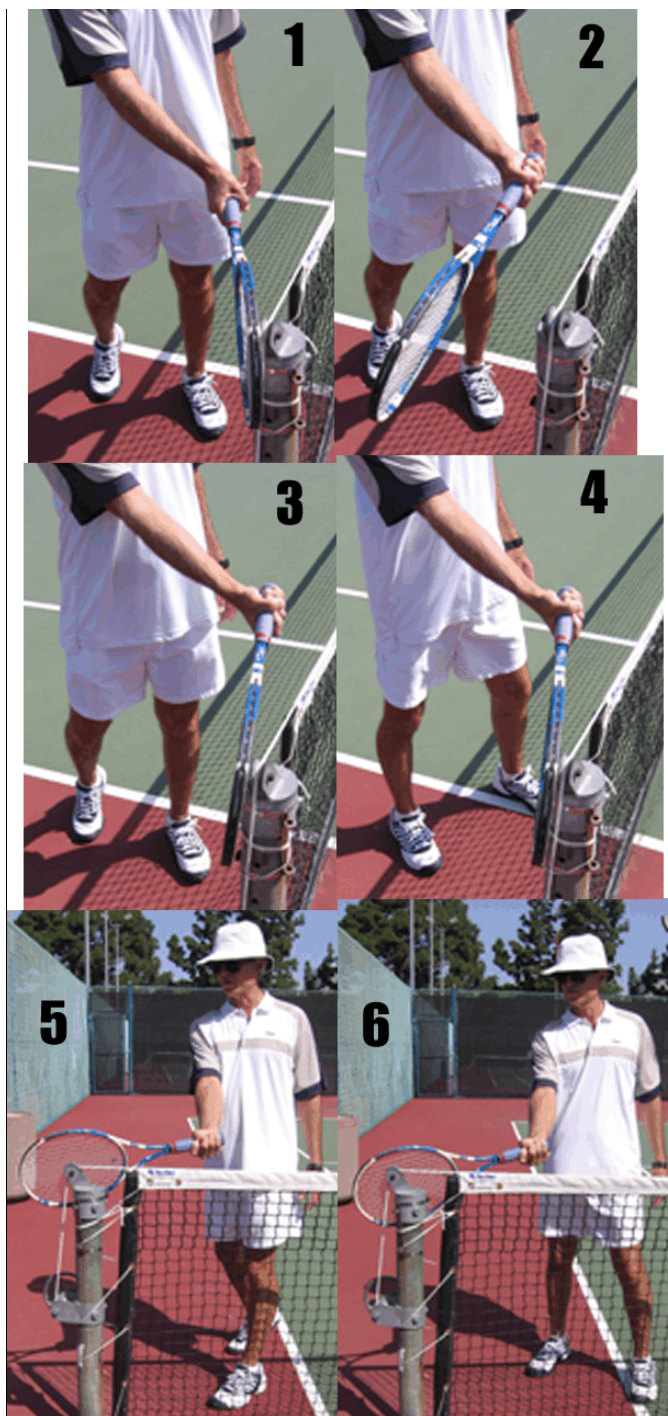
Why the shorter step? Stepping forward into the ball using a Forward or Square Stance with the semi and/or western grips is too uncomfortable to be productive or effective. If it weren't pros would do it and they don't, they open their bodies to get the proper body support (avoid injuries) and hit on time. This is how it works.

Photos on the right illustrate the difference a semi western grip places on the racket face, contact point, body, and feet versus an eastern. #1 is an eastern grip, stepping forward, a Forward Stance, and with the racket on the net post as the contact point out in front (more or less). This all feels good. I switch the grip to a semi western in #2, nothing else, and the racket head lays back all on its own. Making contact like this I am late, I have to push the racket face forward, #3.

In #3 I keep the stance, forward step, semi western grip, and contact point as in #1. But I feel like I am hitting too far out in front for my position, and my back hip and hitting shoulder feel uncomfortable, as would yours. In this position my biceps feels pinched against the side of my chest, #5 where the horizontal stripe on my shirt meets my shirt sleeve. I change only my stance, #4, to hit out in front without feeling too far out in front. This position, #6, eliminates the pinched feeling in both back hip and hitting shoulder. I suspect this is injury prevention as well.

I like the shadow line between my feet, it acts as a marker denoting how the semi-open stance brings both the back leg and hip around and forward, and it marks my racket hand placement. Where I stood at 6 o'clock (back foot) and 12 (front foot) the semi-open stance is at 3 o'clock and 10. And if you draw a vertical axis through the middle of my body down through my groin to the court below it seems I am merely rotating on this axis when adjusting my feet. This is the axis the body turns on best when rotating, not one through the outside back leg and hip as the USPTA manufactures in their analysis of Kuerten's open stance forehand.

It is fun to speculate that if Stan Smith had taken a shorter last step into the ball he would have hit the ball harder for it. [Also he would have rotated a bit more as well, though still moving



forward into the ball first, a prerequisite, and not the other way around.]

Taking a shorter step at the end doesn't guarantee more power, it merely explains how the step-hit works in the open stances. It works like this because of the energy pros bring to the moment prior to that interrupting short step, they are all electric in their positions prior to hitting the ball, bundles of energy waiting to be released.

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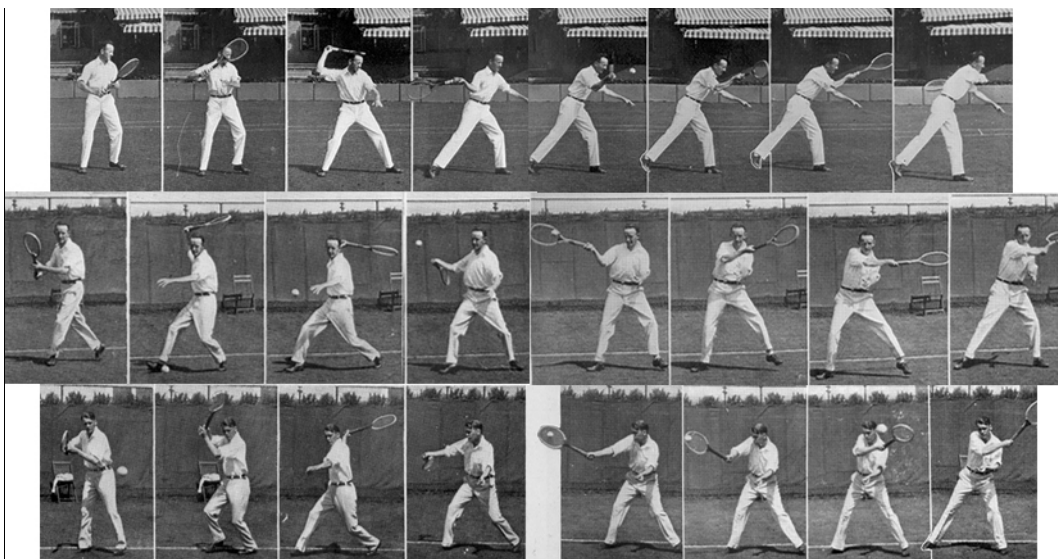
## CONTACT VALUE

It's not merely a question of being turned, coiled, "loaded," these are static terms. Prior to step-hit pros are like the tsunami wave moving fast along the bottom of the ocean with the energy of a widebody jetliner in flight. They are focusing on the contact value, or at least should have been trained to, instead of reacting with loading, rotational gobbledygook. Tennis is all about hitting the ball, yes, but more about the value of that contact.

Contact value is all about how clean the contact was, how favorable to the player the work-results ratio was. Focusing on the wind-up prior to the hit in one's attempt to have an explosive contact merely degrades its value. Next time your pro asks you to focus on all the "modern" tennis stuff tell him,

"I don't need to show you no stinkin' follow through!  
I'm gonna show you great contact!"

The USPTA offers the "modern" technique is an "angular hitting style" that uses a "kinetic chain" to produce "angular" strokes instead of "linear" strokes (and thus more powerful shots). For them a "linear stroke" is a straight line hitting path, I guess following through and holding it out to the net, and "angular" is the wrap around-ish follow through. As seen from 1926 photos the wrap around-ish "angular" hitting style was very much present because all strokes are angular, some more or much more than others, even when hitting flat and straight. Also seen: western grips (top two panels, same player), "loading" (all three), semi and open stances (bottom two), lo-ong step-hit (top), prancing front leg up like Kuerten (middle), outside leg braking to hit (bottom).





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We are indeed throwing the baby out with the bathwater here. Time to stop. The implication is linear momentum is not as materially important to creating our power as angular momentum via body rotation, and that some things "new" need to be added.

We are seeing long established form and structural methods in a predominantly open stance environment and faster game. Calling it new with all the new stuff and distinctions we're supposed to do and be aware of, along with the reams of analyses and breakdowns, makes playing tennis that much more difficult to do, turns people off even. Witness: "The angular hitting style includes *several footwork patterns* that work in *different situations* [italics mine]." "Six General Performance Components... Footwork is only one of the 43 subcomponents." ¡Ay!

Want to hit better? Open up the stance a bit, still push off the back foot, still use your step-and-hit but a shorter step. Remember the ball's angling away from you so don't shift away from it.

There is a need to open your stance from time to time, but that's not "modern" by any means. You already do that on your own, you may be unaware of it. You also stretch your muscle groups more from time to time for more oomph, but you already turn and "load" like that from time to time and may also be unaware of it. Your tennis teacher should be pointing out to you how you hit these marks naturally from time to time as s/he leads you down your road of self-awareness. You already do this, it's been there all along. Don't complicate matters.

Tennis is not rocket science,  
nor science of any kind.  
Move forward into the ball and step-hit,  
or step-hit and move forward.

And now it's time to clear up our confusion.

# Revolutionary Tennis

## Tennis Instruction That Makes Sense

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### MODERN TENNIS NOT

#### Part 3

#### Thinned and Confused: Tennis Science, Video Analysis.

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It seems like everywhere you read physics is being invoked to justify one's point of view on how best to hit the ball. In fact individuals with professional doctorates head the various USTA and USPTA Sports/Education Committees, and intellectuals from other fields have been drawn to tennis. The sports science crowd loves to say, "you can't change physics," and teaches you how to play according to science. Educators say, "this is what we know," and analysts say, "we agree to disagree."

Everyone has their own line judge with a Ph.D. in biomechanics to make the call on how things work. Nothing against these people, but I thought if evidence one party uses to support one's hypothesis can be contradicted or used to form an alternate hypothesis then intelligent minds would prevail and further work would be noted. But if you have attended a tennis teacher conference you may have witnessed broad dismissives to those in the audience who sincerely see or offer a different interpretation of what is being presented. "Doesn't look that way to me," one tennis teacher clearly said from the back of the small room after the video analyst described the moving parts to Sampras' serve using slow motion video. The speaker ignored him.

In the 1926 book, "Mechanics Of The Game," the author clearly shows modern tennis at work - loading, exploding, western grips, wrap around strokes - and in fact was "disillusioned" there was no "stiff wrist" as he assumed "in making the best forehand stroke," a perceived slight on his understanding of the game he made up for by labeling it falsely a "snap" of the wrist. Today's scientists use modern equipment with today's language to sell you on the same "new" technique, but just as yesterday's scientists and observers were incorrect in a lot of their assumptions today's scientists and observers are incorrect as well as shown in Parts 1 and 2 above.

Perhaps tennis science really isn't science at all. The Ph.D.s use the right equipment, they have the right education, but maybe there's something about tennis that's not showing up in the science, maybe science is not replicating or looking at the right spots in tennis.

Here is one look how scientists set up their experiments and how analysts understand what they see. Judge for yourself.

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#### EXHIBIT A: TENNIS EXPERIMENT

There was an experiment performed by a tennis scientist working with a "certified" tennis pro to determine which stance produced more velocity on the shot, open or square. I sent an email to

the tennis scientist because I wanted to know more about how they set up their experiment. I was curious not about the conclusion but about how the experimenters defined the square stance and how they distinguished between the different types of open stances and their methods of shifting body weight. Here is the email response to my questions.

On Thu, 06 Sep 2001

Dear Mr. Blackwell:

1. What was that video you supplied them with? [a video was used for instruction] I'd like to get a copy for my own edification. Is your open stance definition facing the net, or something else?

A - The video was simply a segment from an instructional video...I can't remember where I got it...and I'm in New York now, so I don't have access to it. We gave them simply general instructions that they should step forward (toward the net) for the closed and their feet should be more parallel to the net during the open stance.

2. There are two types of open stances, one where the weight shift is kept on the back foot during contact, the other where it's kept on the front foot. Which type did you use as your model?

A - We didn't care about the weight shift...so we didn't make any statements about it.

3. In the open stance, were the feet allowed to leave the ground, did the subjects switch (their forward/backward) positions of the feet after contact?

A - They were allowed to do whatever they wanted in terms of leaving the ground.

4. In either square or open stance, did the subjects move into position to take a step prior to contact or were they standing in-place?

A - They were in place, as the ball hit a small carpet each time it bounced on the court, so they knew exactly where it would be. But they still were allowed to step into it.

5. In the square stance, to what object did the front foot step and where was the toe pointed?

A - We only told them to step toward the net

It is possible had I run this experiment using different types of weight shift from an open stance, moving to the ball prior to the hit, and stepping forward towards the ball instead of towards the net the results would have been the same. What is more relevant, though, is the work-to-results ratio, that is how much work each position requires for the result created, but this was not a goal of this experiment. For this reason alone this experiment is not substantive enough, and when you incorporate it did not understand the open stance that uses the step-and-hit you have to wonder about its authenticity and relevance.

Consider this logic where science "proves" method:

A. Power in a tennis serve comes from the contribution of larger muscle groups: torso, hips, shoulders, and arm.

- B. The wrist "snap" does not contribute to power in a serve.
- C: Thus there is no wrist snap on a powerful serve.

[This sorry red herring of an argument will be put to rest in a following paper using academia's own figures and observations.]

We are smarter than this.

Consider this logic where science proves choice... if you can figure it out

From USTA Sport Science Committee White Paper On Tennis Technique And Injury Prevention  
Published August, 2004:

- In general the player will feel **less shock**/jar from ball impact when using a **heavier racquet**, but this racquet will require more muscle activation to get it up to maximum velocity through the hitting zone. **If injuries** are felt to be due to shock/jar or twisting due to mis-hitting or poor technique, or due to playing more powerful opponents, **then a heavier racquet** with a larger head may be **preferred**.
- The player will usually **generate more power** by using a **lighter racquet** that may take less muscle activation to generate maximum velocity through the hitting zone. **If** the arm **injury** is felt to be due repeated use in many matches, **then a lighter racquet** may be preferred.

From USTA.com's site: Technique: Racket Selection 10/14/04:

Frame mass. Modern tennis rackets have been getting lighter and lighter. However, **greater racket mass** is directly proportional to **greater speed on a ball**, if all other variables remain equal. The other advantage of a racket with **more mass** is that this mass **helps protect** the player's arm by being more resistant to the acceleration of impact. Example—Very light rackets are great for the fast movements of a serve-and-volley player, but provide less protection to the arm during the shock of impact. You might suggest to a player that he or she **increase racket mass to help protect the arm** or to mechanically discourage a tendency to swing wildly (over hit) at shots.

(Biomechanics research is uniquely qualified to provide information for racket selection...but much is still not known about how racket design elements interact with the player in affecting performance or risk of injury.... Some key design features that have been researched and have stood the test of time are the variations in head size, frame width, and racket mass and distribution of mass)

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## EXHIBIT B: ANALYST'S OBSERVATION

Just how many different types of forehands does Roger Federer hit according to the tennis analysts? Four, five, six? One tennis player analyst on the net claims at least twenty five variations. This analyst say he has different kinds, as in different stances, different footwork combinations, different follow-throughs. Assuming for a moment this opinion is literally correct, how did Federer learn all those different types, and how does he manage all of them? How does



he know when to do which one, how is he able to execute type "O" stance with a type "2" footwork combination, type "Ypsilon" shoulder, type "Granada" wrist, type "Gecko" arm flexibility, and type "Deca" follow through? And how does this help you?

Analysts try to break it all down so you, the student, learn to do type "2" footwork to match up with type "O" stance because the ball will be "like this high" when you hit it or you are "in this area of the court" and trying to "attack/defend/disrupt" your opponent. While this analysis is not literally incorrect, two things do jump out:

1. Looking at a pro's stroke this way is indeed paralysis by analysis.
2. Can't these variations share a common source or do we learn each one individually?

As admiration of a pro's talent it's wonderful to read about multiple forehand variations, but how does this help you? I bet you feel you should be able to emulate some of these variations because you're smart and a good tennis player. How, then, by understanding the situations in which they are used? Para-nalysis again.

### **WORK-TO-RESULTS RATIO IS MISSING**

Either this is the realm of the supernatural professional athlete and regular folks are just out of luck, or there is a simple keyhole to all of this. The first keyhole that leads to these variations, the master keyhole to the timing and-then-rhythm for it all is the singular fundamental seen in Part 1. [Second and third keyholes for stroke contact and finish are held separately here.]

Unfortunately for us the teaching of Federer's truly updated forehand borne from simplicity is being ignored and a "modern forehand" is promoted where the work-to-results ratio is not the same. The "modern forehand" is too convoluted for its own good.

What about injury prevention from the overwork it takes to produce results one way versus another? I heard a major teaching organization's head with a Ed.D. say that if the playing pro did everything correctly there would be no injury, to which a touring pro who happened to be in the room piped up about his own hip injury and its relationship to the loading and rotation. The speaker said his form needed adjustment and he needed to strengthen the related musculature. Ah, blame the athlete.

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### **'WAX-ON, WAX-OFF'**

In the popular movie "The Karate Kid" a martial arts master is challenged to improve a desperate student's karate. The student wants to learn the complicated hot moves right away but the master instead has him apply "wax-on, wax-off" to his numerous old cars to show him that complexity is borne from simplicity.

An artist gave me a similar example from her world, lamenting how today's artists out of art school want to do Picasso's modern art right away. But what they didn't get, the artist told me, was how Picasso was an excellent draftsman for years before he turned the art world on its ear with cubism. Picasso could draw beautiful figures, hands, animals. In other words he learned what is an artist's bread-and-butter before his genius blossomed.

So how does Roger Federer manage all those forehands? He doesn't, because it would be impossible. He doesn't manage different types of footwork, different types of follow throughs, different types of body input. By learning only one basic type for each category he is able to organically adjust and adapt to the circumstance without having to think too much about. Thus the different "types" we see in him, and, truth be told, in other playing pros. And the better pros started out with better fundamentals, i.e. step-and-hit. It's that simple.

### **AVOID CONFUSION**

The "modern forehand," a.k.a. "angular hitting style," opines "angular momentum, rather than linear momentum, [is used] to power the shot" and to do this the body movement during the swing is a "drive upward" to unleash the coiled, or loaded, spring-like body that often finishes off the ground with the back foot coming forward. This is advocated by academics in various teaching organizations to achieve greatest racket momentum, power, and this "angular hitting style" is drawn as a direct contrast to what they call the traditional/linear model of "Turn-Step-Hit."

Poppycock. Don't be confused or misled, unless you want to look like a frog jumping from one lily pad to another. Tennis pros from yesteryear and today all say moving forward into the ball is the holy grail to tennis. And as today's track athletes do not use a "modern" gait or structure to running tennis players today do not use a "modern" method in their business (the swinging volley perhaps excepted).

Move forward into the ball, step and hit. Either area can be tweaked a bit, modified, amplified, each can be broken down into little pieces to both teach it and get more out of each piece. But the overall picture remains the same. If I am going to explode it will be forward into the ball. If forward into the ball my back foot is going to push. If my back foot pushes I am going to need to step-hit. If I am going to step-hit I need to load first. If I load first I need a timing step second. If I need a timing step it should go forward.

**Tennis. Forever.**

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## MODERN TENNIS NOT Part 4 Hiding In Plain Sight

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A quick example follows showing how tennis science doesn't look at the right spots in tennis to justify their beliefs and hypotheses, or doesn't see what's hiding in plain sight. The following is taken from the USTA's own High Performance Coaching Newsletter For Tennis Coaches, and "The Forehand Stance" uses three Federer forehand models (seen before in **Revolutionary Tennis**) to illustrate differences between the square stance and the modern semi-open and open stance.

The article starts off saying each of these three forehands is "situation specific" - a serve return, 2 groundies - and that "both linear and angular momentum are important to all strokes." But then the analysis confuses the reader by saying linear and angular momentum are two mutually exclusive ways to deliver racket head speed, said speed delivered from either linear momentum in the square stance ("transferring weight from back foot to the front foot"), or angular momentum (trunk rotation) from the semi-open and open stances. Doesn't make sense.

It is of utmost importance to compare things correctly, fairly, properly. Failure to do so leads to confusion, miscommunication, loss of player participation. We must compare apples to apples, and not apples to walnuts.

## "2. Both linear and angular momentum are important in all strokes"

"What is momentum? Momentum is the product of an object's mass and velocity and essentially defines the "quantity of motion" the object possesses. Linear and angular momentum define the amount of motion in a straight line or in rotation, respectively. In the square stance forehand, players step toward the ball, transferring their weight from the back foot to the front foot (pictures 2 and 3 in the bottom sequence). This allows linear momentum to be generated which then contributes to racket head speed and the force of Federer's forehand. In the open and semi-open stances (top 2 sequences), Federer relies heavily on trunk rotation to generate racket speed and therefore, these strokes predominantly use angular momentum; research has shown that there is very little forward motion of the body's center of mass in an open stance forehand." [pictures below read 1 - 6, left to right; square bottom row, semi-open middle, open top row.]



Part 1 in this paper above clearly shows Federer's semi-open and open stance forehands providing "forward motion of his body's center of mass" and of transferring weight from back foot to front. This meets the USTA's definition of linear momentum and proves he *may* not rely "heavily on trunk rotation" for racket speed out of these stances. And since the USTA admits research has shown the presence of linear momentum in an open stance ("very little") perhaps science should ask, "How does the body's forward motion affect racket momentum since it's present in every stance? Which stance helps this best? How does the body's forward motion affect the role of the stroke's natural angularity and vice versa?"

Furthermore the same angularity of heavy trunk rotation the USTA analysis reads into the semi-open and open photos can be seen in Federer's square stance photos as well (later). But first a closer look at their photos regarding linear momentum only from a square stance.

The right 4some shows the square stance on the bottom two and semi-open stance on top. The bottom is "pictures 2 and 3" of opinion "linear momentum [being] generated [using the square stance] which then contributes to racquet head speed and the force of Federer's forehand."

The top are pictures 2 and 3 from the semi-open stance where the USTA opines "... Federer relies heavily on trunk rotation to generate racquet speed and therefore, these strokes predominantly use angular momentum."

Federer in both stances has the front toe off the ground first and in the top semi-open he step-hits and his back foot pushes forward into the ball (heel off the ground). To say Federer uses only trunk rotation for racket speed in the semi-open stance here simply overlooks what the feet are doing. Hiding in plain sight with these photos, and seen earlier in Part 1 above, this omission seems to be a choice to satisfy a "modern" forehand hypothesis.



The USTA tells us, "linear momentum... [which] then contributes to racquet head speed and the force of Federer's forehand" occurs [only] out of the square stance. But since linear momentum is also seen in Federer's semi-open stance it *is* reasonable to say linear momentum also contributes there to racket head speed and force.

The USTA excludes this hypothesis because it opines, "In the open and semi-open stances (top 2 sequences), Federer relies heavily on trunk rotation to generate racquet speed and therefore, these strokes predominantly use angular momentum." By omission it is being said the square stance does not rely "heavily" on trunk rotation or that it is more pronounced in the semi-open and open stances.

A careful look at trunk rotation at similar points does not support this hypothesis. Photos comparing the trunk's rotational angles in all three stances show very little if no difference among them, though of course the lower body is different. Perhaps tennis sports science tries too hard to reflect textbook analysis when explaining how the body works to produce the best tennis strokes. But judge for yourself.





First two left: bottom square stance, top semi-open. The angle of the torso, judging the turn of the shoulders by both the white stripe on the front sleeve and the amount of space between the white stripe and the back shoulder indicates an almost identical angle. The difference besides the angle of the hips is Federer is leaning over.

Second two left, bottom square, top semi-open, show a highly similar shoulder angle, the differences again being the hips and Federer is leaning over. The angle would be the same were he upright.

Third, three photos high, the top open stance is identical to the semi-open beneath and to the square below but for Federer's seesaw tilt (small logo on the right shoulder visible in all).

Last two on the right bottom/top are identical, only the turn of lower body in the square stance (bottom) prevents the shirt front rising and the hips from opening more.

It is quite clear trunk backward/forward rotation of similar, if not equal value is present in all stances. The trunk turns more from a semi-open or open stance against hips that aren't turned literally sideways, true, but if you were sideways you wouldn't feel compelled to turn that extra amount because you are going to step forward into the ball. Regardless, it is disingenuous to imply trunk rotation is not very much present in the square stance because it is.

Would you rather rotate "heavily" with angular momentum for your stroke empowerment and be like Kuerten or Nadal? What is the distinguishing factor here between Federer and his peers? More or less work? More or less forward movement? More or less torso rotation? More or less elegance? The distinguishing factors are less work, more forward movement, less torso over-rotation. Simpler. Cleaner. Elegant.

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### **KINETIC LINK GOES UP INTO A SERVE BUT GOES UP, THEN OUT ON ALL OTHER STROKES**

The USTA (and others) talks about, "The ground reaction forces are transferred ["from the ground up"] through the *kinetic link system* all the way up to the racquet," and that Federer "transfers forces so efficiently that he creates a beautiful flow of linear and angular momentum culminating in tremendous racquet head speed." Of course "modern" tennis is seen as the best vehicle for this "beautiful flow of linear and angular momentum" to take place though the import of linear momentum remains the forgotten child in their own separate observation:

"The kinetic chain is very much involved in the forward swing. It is the differentiating factor between angular and linear strokes, or modern and traditional shot making (USPTA Player Development, Vol. 3, #1, 2006)." [I guess traditional tennis pros didn't use the kinetic chain principle.]

The kinetic link system is a "coordinated sequential movements of the segments of the body to build force from the ground through the hips and trunk to the shoulder and into the arm, hand and racquet." The hypothesis says this force-momentum is transferred up the body and into the racket. This holds neatly and maximally when the arm is raised overhead like on a basketball shot or on a tennis serve as an *upward linkage*. But when we swing around our body and not either directly overhead or down as in golf how does this force transfer "up" in the same *neat and maximum* manner? It doesn't.

The strongest hits come on serves, not groundstrokes, evidence of when the linkage system is expressed neatly and maximally and when it's not. Swings that happen around the body, as in all racket and stick sports, boxing, martial arts, this same linkage system is not so elegantly expressed. Try as you might it's never just a question of loading and unloading, winding and unwinding.

Baseball batters take a short stride forward with the front foot before rotating massively and swinging around the body. The short stride is linear momentum, the weight transfer is athletic rhythm, but scientists say the power delivered by linear momentum is very little when compared to angular momentum from body rotation. Then why take the small step, why not just stand still and bat? Because this small step is the keyhole through which their massive rotation works.

Advocating for angular momentum as the main vehicle to deliver the body's kinetic link system

looks good in textbooks but in practice, *for a tennis player*, there's a large "but." Why?

"Additionally, due to the reliance of angular momentum in many of the open stance shots, mis-timing the intricate series of segmental rotations can lead to the ineffective power transfer through the kinetic link system resulting in musculoskeletal injury." USTA High Performance Coaching, Vol. 8, No. 2, 2006.

Why must there be a "reliance" of angular momentum with its intricate series of segmental rotations? Is there a solution to avoid the "mistiming" that leads to either a weak shot or injury? I don't think baseball says if you mis-time the hit it results in injury, they just say you blow it. The point is we shouldn't rely either solely or materially on angular momentum, there is a preceding element: linear momentum, moving forward into the shot.

Furthermore, the USTA Sports Science Committee White Paper On Tennis Technique And Injury Prevention lists how the kinetic chain is used on the modern forehand, and missing is any mention of linear momentum or of stepping with the front foot. Their four examples of the kinetic chain are:

"Ground reaction force as the base of the stroke;  
Strong leg drive off the back leg;  
Trunk rotation around the back leg;  
Long axis rotation of the entire arm so that the elbow points towards the path of the hit ball."

Curiously the "trunk rotation around the back leg" means using the back leg and hip as the axis of rotation, instead of using an axis through the center of the body. On the one hand they claim this rotation is part of the kinetic link and how-to of the modern forehand, and yet they also claim in another High Performance newsletter, "However, even when performed properly, the loading of the dominant side hip is an inherent characteristic of the open stance forehand and must be considered when preventing and/or treating injuries in the lower body." The full scope of the USTA talking out of the other side of its mouth can be seen in the rebuttal section **Head-On**.

Tennis is a different game. Textbook description of the body's linkage system in generating momentum only goes so far. While we "can't change physics" we can change how physics explains what we do.

Here's to tennis scientists explaining how and why forward movement is associated with the best tennis, how linear momentum is the structure through which Federer produces his "beautiful flow". Perhaps it's time for research scientists to begin with tennis instead of science when trying to prove the mechanics of our game.

I'm sure physics professors cringe at how fast and loose tennis is with linear and angular momentum. What about conservation of momentum, how does this fit into our picture? Perhaps this conservation of momentum is made simpler by moving forward into the ball as opposed to standing with a wide base and trunk rotation around the back leg?

**MOVE FORWARD INTO THE BALL.**  
**There's a lot more to it than meets the scientist's eye.**

[Credits where known: Smith photo by Fred Mullane, Tennis Magazine, 7/89; Guga: USTA High Performance Coaching newsletter Vol. 8, No. 2/2006; Marco Scutaro by Marcio Jose Sanchez/AP; Paradorn Srichaphan, Brian Bahr, Getty Images; Miguel Cabrera, LATimes, Alan Diaz, AP; Stephen Drew, LATimes, Lenny Ignelzi, AP]

# Revolutionary Tennis

## Tennis Instruction That Makes Sense

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**HAND USE FOR CONTACT:**  
No twisting. No miss-hits.  
On purpose.

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### **Andre Agassi**

"I take the ball on the rise and play with a lot of wrist."  
Inside Tennis, Oct/Nov, 2001.

### **Roger Federer**

serve: "How much you twist your wrist to give it spin and speed and so on."  
strokes: "[I use] different grips for different shots."  
To PBS Interviewer Charlie Rose after winning the 2004 U.S. Open.

### **Pancho Gonzalez**

"You must have a firm grip on the racket when you make contact with the ball."  
World Tennis magazine, June, 1987.

Two facts you're aware of at contact: you get miss-hits, and your racket face often twists in your hand. The same happens to pros, but pros minimize this twisting and dampen the miss-hits. If you can do the same perhaps it's the most direct road to more power and consistency.

The racket twists at contact, or oscillates, no matter the grip, the stroke, the stroking style or your physical strength, and you often think it's because you were either late, weak, your hand slipped, you hit off-center or had a bad stroke against your opponent's screamer. You wouldn't be wrong in your thinking but there is a core issue here since it also happens against regular shots and floaters - you know, the easy sitter or high volley you should whack to win, and yet... In addition to vision requirements you have to ask yourself:

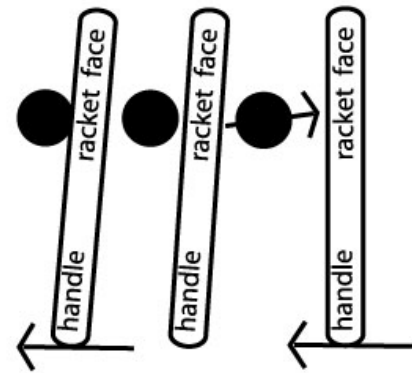
### **AT CONTACT:**

**How do I prevent the twisting and stay true through the contact zone?**

On a subconscious level you know your swing will counter the ball's resistance against the racket (Newton's third law, for every action there is an equal and opposite reaction), and even though the ball's opposite force may not be literally overwhelming this reality adversely affects your swing pattern. Though you can not control physics you need to know how to maintain the integrity of your swing pattern to reduce the twisting and get the best shot possible. To do this like a pro means knowing how to use *your hand* for, and during, contact. How to do this?



You hold a tennis racket by the handle and swing an area some 20 inches away from the handle to hit the ball. What happens is you either move the hand/palm forward to "hit" the ball as if you were playing handball, move the hand/handle past the ball before contact, or the hand/handle keeps on going forward while the racket face decelerates (goes "backwards") the very first millisecond it hits the ball. When the bottom of the racket (handle) moves faster than, or remarkably ahead of, the top (racket face) at contact the twisting increases because the hand no longer supports or controls the racket face lagging behind.



The two photos on the right of me hitting the white tape that represents the contact moment are real-time stills taken off a QuickTime movie. On the left is contact against the ball when I hit the tape, and on the right when the hand continues past the tape the racket face can no longer hold true within the contact zone.



A top player manages to avoid this twisting of the racket face *more often than not*, and when at times they don't it's for the same singular reason as you because it happens all too easily. That reason is not so much directly related to the undeniable physics at play, the reason is the pro's hand traveled farther ahead than the racket face either before or during the contact moment $S$ . I say contact moment $S$  because to say contact momen $T$  implies but one moment. The ball is on the strings for 4 milliseconds, sometimes longer. That's at least 4 contact moments, and you can add to that total a few more milliseconds after the ball has left the strings since your response and/or reaction to the physics of contact still influences the racket's forward path for your follow through.

High speed contact photos of pros consistently show the hand(s) holding firm while the racket face moves on through the contact, high speed photo shows detail work such as hands, wrist, eyes much better than high speed video. Even taking into account the slight difference in depth of field issues of pro, hand, and racket face these kinds of photographs are both abundant and consistent in what they show. They show the hand firmly around the handle and more in focus than either ball or racket face, you do not see the hand progressing through the shot or farther afield at this moment, and you don't see any finger(s) off the handle; the arms are flexible, faces grimace (except Federer's), strong muscle contractions are visible in one or both arms.

Clearly a lot of mental as well as physical effort is being exerted to deliver the shot. Everyone grunt!

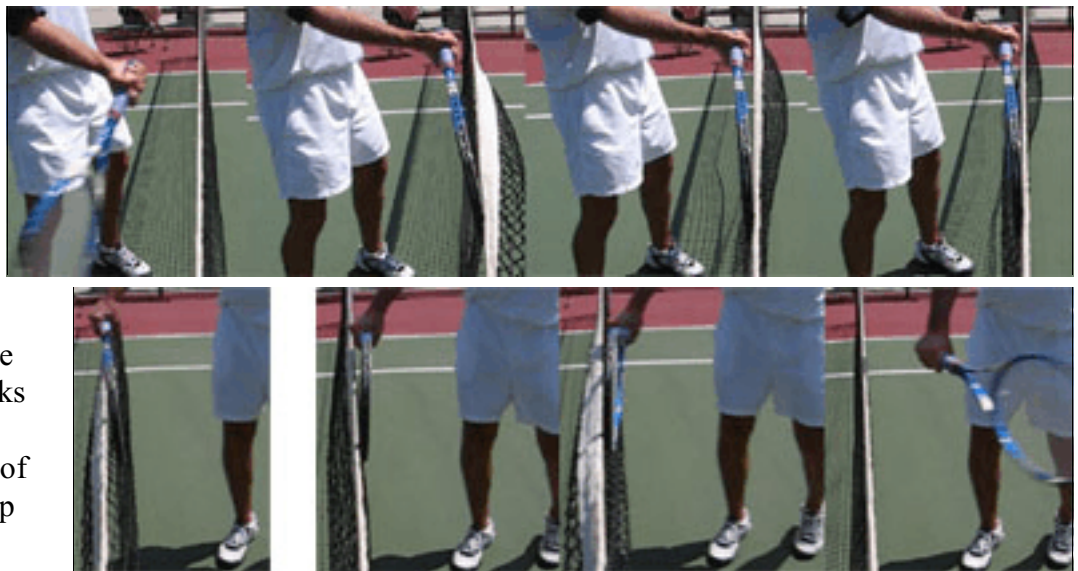
## AVOID TWISTING: PREPARE YOUR HAND FOR CONTACT

To control the ball better at contact you do not want your hand to move forward during the contact moments, you want the hand to support the racket face. How? By **holding** on to the handle or **firming up** the hand for/during contact. Additionally this preserves as much forward racket momentum as possible into the ball during contact's deceleration, keeps the racket head truer in the contact zone during the contact moments, and it keeps your focus where it should be: on the contact and not on the follow through or ball placement. This is also known as firming up the grip for contact, and now you can understand why.

This firming up does not mean you start holding the racket with a firm grip while in the ready position, it doesn't mean you hold the racket in a death grip while moving to the ball, it also does not mean locking, or keeping rigid, either arms or wrist. Firming up does not mean you will lose having a flexible, or loose, arm or wrist. Firming up is also referred to as a firm grip, strong grip, strengthening the hand, firming up the wrist, squeezing, resisting - you get the picture. Firming up helps prevent the hand from traveling past the contact spot faster than, and ahead of, the racket face.



To illustrate, the following stills show me swinging as hard as I can into the tape that represents the contact moment or contact spot. The racket face whacks the tape but my hand stops short of the tape and a gap remains (as illustration). My hand braces for



impact, or resists, to maintain racket momentum and stability during contact, my hand does not move on forward ahead of the racket. [Last photo backhand left side shows hand not bracing but continuing.]

Bracing your hand for contact stops the hand from moving on towards the net during the impact moments when the string bed slows down, without this bracing the hand/handle continues on (and the racket face opens). This does not mean your hand/handle stops-in-its-tracks, no, the stroke continues, the hand/handle moves on, it does not move on ahead of the racket face carelessly.

Practice hitting the tape like this to learn how to brace for the impact, but please drape a small towel over the tape to protect it while you whack it. I know this is a simplistic example, but it illustrates what is going on with a pro's hand for impact. This simple understanding is often lost in the noise proselytizing the grip must be loose during contact since both wrist and arm are flexible/ loose at contact. And these noisemakers explain the grip firms up "naturally" or "involuntarily" at contact so you don't lose hold of the loosely-gripped racket at contact. Their thesis is a firm grip can not exist with a loose, flexible wrist. Of course it can. More later.

Using a more western grip, or when hitting inside-out to the opposite court or up the line, the hand during the contact moments when viewed from the side can be seen, and is, on the same horizontal plane or even ahead of the racket. These examples make it easier for the hand to move on forward too much too quickly and underscore the greater need to brace for impact to help control the shot. No wonder you lose control on the inside-out shot, no wonder you lose control when hitting late on purpose.



If you brace your hand for contact your shot will immediately improve in quality, sound, and power. If you know to brace you'll do it easily prior to the contact, your hand firms up, squeezes, strengthens for the impact, and at the same time both your wrist and arm will remain loose, flexible, and strong. After contact the grip loosens, the hand and fingers relax (twirling the racket anyone?), and when the ball is returned you go through it all over again. If the ball sails on you or you miss-hit try to recall whether or not you braced for the impact, whether or not your hand traveled further afield too much.

## THE HIGH VOLLEY

The difficulty with the high volley can now be appreciated. We either hit the ball down into the net or the ball sails. The ball will go down if we hit too early, either because we stop too soon, or "extend" and hit out in front too literally (and too early), or don't look for the contact from behind the racket face. **Solution:** wait to hit, patience, let the ball come in a bit more.

When the ball sails the racket face was angled back because the hand/handle was shoved forward at the expense of the racket face. In our zeal to smack that high volley our hand just loves to move faster than, and ahead of, the racket face at contact. **Solution:** don't over "punch" on the ball, stop the hand from moving forward during the "punch."



Another little tidbit in all of this is how the racket face rises higher or lifts more than the hand during execution. The two photos here illustrate the racket face first below the contact spot and how it rises, or lifts, low-to-high. But the racket head lifts more than the hand, the hand does not lift up equally or in unison with the racket face. It's as if the hand were in the middle of a clock face to some degree and the racket face was one of the clock hands moving up clockwise or counterclockwise.



And now the obfuscation begins, this is where this little paper opens up. You don't have to keep on reading to gain the benefit outlined above.

### **A FIRM GRIP? A LOOSE WRIST? VOLUNTARY OR INVOLUNTARY?**

Dr. Stanley Plagenhoef, author of *Fundamentals Of Tennis*, 1970, and our second tennis scientist of note after J. Parmly Paret, says in his book's first sentence: "The firmness of the grip at impact is the single most important factor in hitting a tennis ball." In fact he showed with force-transducer tests in the 1960s grip firmness before, during, and slightly after impact on groundies and right at impact on the serve (but I don't have that paper, just a reference to it).

Since Plagenhoef a lot of studies have been done confirming grip firmness translates into the ball rebounds off a racket with higher velocity vs. a grip that is less firm. Should be no problem, right?

Problem is either Plagenhoef or someone else bought into the idea the hand's firming of the grip was an involuntary act. In other words just like your heart beating or your lungs breathing (which you can stop, but then need to use again) grip firmness is seen as involuntary. Since then tennis scientists and video analysts inform the tennis public grip firmness happens "naturally."

Everyone knows if the grip is loose-loose the racket can fly out of your hand or twist too much on contact. In order to avoid either the tortuous twisting or the devastating destruction of your tennis racket today's scientists and analysts explain the grip tightens for contact *involuntarily*.

But there is a huge problem with this singular involuntary act in a field of voluntary ones.

These same scientists and analysts look at video of the pros and ask you to perform certain movements to match what they see on the video (e.g. turn shoulders, tuck elbow in, extend the

butt cap or palm to the ball, extend the elbow or turn the arm or lift the triceps up to the ball). While you are asked to swim in this ocean of *voluntary* movements the tightening of the grip is *involuntary*?

There is yet more spin. The pronation seen on the forehand has been either A), a *voluntary* choice made by the pro after contact, or B), an *involuntary* one as a release of natural forces. On the serve you are told the pro's loose grip is *voluntary* and that pronation is also *voluntary* (because it's necessary).

So I have involuntary grip firmness responsible for either a voluntary or involuntary effect on my groundstrokes and a voluntary grip for a voluntary effect on my serve? Am I the only one who says there is something wrong with this logic?

Those who claim a loose grip for contact do so to match what they see before and after contact, that is a loose wrist and a flexible arm (extension then flexion to a neutral position to pronation and deviation, or supination to extension and deviation). They can not fathom the grip can be firm and the pro still retains a flexible arm and a loose wrist. It is their lack of experience.

From **Pancho Gonzalez**, World Tennis magazine, 6/1987:

"Hold your racket firmly enough so that someone can't pull it out of your hand.... The hand gradually firms up to and through the point of impact.... relax after you have made the shot... Remember: You must have a firm grip on the racket when you make contact with the ball."

Serve: "fairly loose throughout the swing... a little tighter [for] ball contact and gradually increase the pressure of holding the racket."

Return: "racket should be held more firmly when returning from inside the baseline."

Volley: "more firmly because it is a shorter stroke."

It may be grip firmness at a lower skill level is involuntary when you are generally unaware of what you're doing, but it becomes more voluntary as you improve and you improve by being aware of it. You learn its benefit as you improve and it happens because it has been both drilled into you and you've learned due to the demand.

What would we see in the countless super slow motion videos of tennis pros on YouTube if the hand were *strengthless* during and after the contact moments? We would see either:

- the hand and wrist bend (extend or flex) through the contact moments;
- the racket face twist a lot or drop precipitously;
- the player lose their grip or lose the racket, or
- the ball sail.

In the slow motion videos we see none of that. The hand holds firm throughout the oscillations, the racket face continues on, the ball does not sail. The deduction is *there is strength in the hand*.



## THE GRIP IS FIRM. THE WRIST IS LOOSE.

After contact the racket head remains blurry while the hand doesn't, as Agassi and Roddick show here, because the racket head is traveling faster than the hand. And if the hand is not holding firm quite obviously the racket flies out of there and hits a line judge. (Mac would like that.)

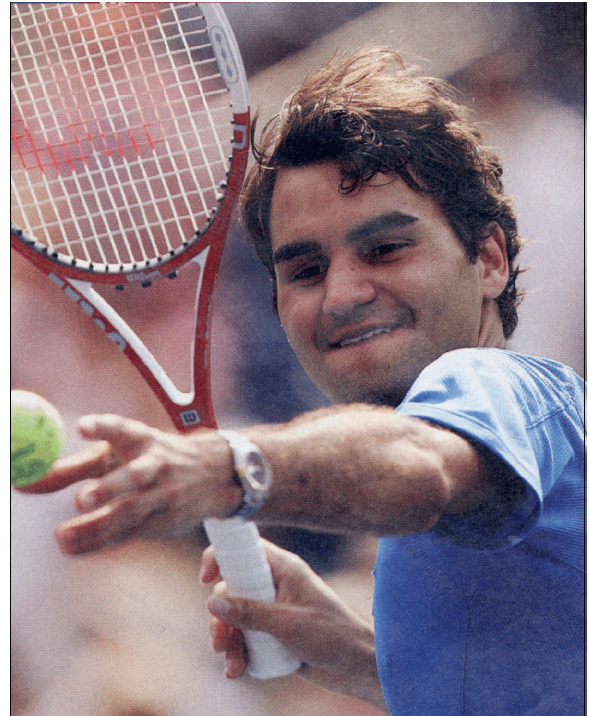


Question then is: Can we have grip firmness and a loose wrist, grip firmness and a flexible arm? Of course. And that's voluntary. The analysts make their mistake assuming "a minimum amount of grip pressure to control the racquet" at contact is needed to match both a loose wrist and an arm that is not "rigid or locked." That is not the case at all with a top player, or you. At contact you can have a firm grip with both a "relaxed arm" and a wrist however you like. This is how a pro does it.

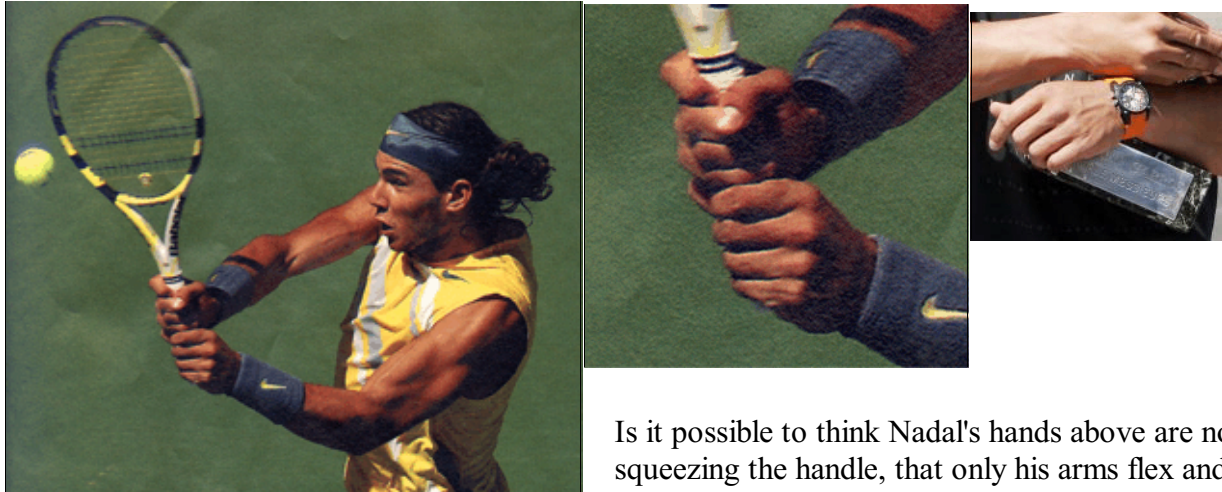
Federer on the right shows what a loose grip looks like on the racket handle, the photo catches him changing his grip to hit a ball into the stands celebrating a victory. The thumb is straight and not wrapped around, his bottom two finger tips are off the handle.

Many tennis scientists and observationists don't like the idea of the voluntary firm grip since they can't see the hand or wrist doing *something* during the contact moments as the pros claim. Video watchers divine details from a medium that can neither prove nor disprove this kind of detail yet claim sacred ground absent proof to the contrary.

Andre Agassi says he uses "a lot of wrist" on his strokes, and if he voluntarily uses his wrist he voluntarily firms up his grip. Sadly, though, our modern tennis scientists don't help you by explaining how he does this, instead they call him a liar by preaching Agassi has zero degree of wrist displacement based on the slow motion video they analyze and then they offer their truth as to how he does it. I guess Andre just doesn't know what he's talking about or isn't aware of himself...?



You can try this for yourself. Grab the racket handle with your forehand grip, squeeze the grip and keep the racket face perpendicular to the ground. First off you can flex your arm, it remains flexible. Next flex/bend the wrist backwards then forwards. You can't, really. Flexion and extension are difficult when squeezing. Now make the racket edge go up and down, knifing the air. This you can do, it's radial and ulnar deviation in the wrist. Next pronate and supinate the hand, opening and closing the racket face so to speak. This you can do as well. As you can see grip firmness coexists with arm flexibility and wrist movement of the pronation/supination, ulnar/radial deviation kind.



Is it possible to think Nadal's hands above are not squeezing the handle, that only his arms flex and his hands are not firm? Even when his pinkie finger shows stress? Is it possible to think this act is involuntary on his part? Neither sound minds nor experienced players would think so. Compare his left hand when calm and holding a trophy, above right.

When we take the racket back we don't squeeze the handle because we first will extend our wrist backwards at some point before dropping the racket face into the forward swing. When dropping the racket we are squeezing the handle and though our wrist flexes (or extends) forward a bit at this point we mostly engage the ability to pronate, supinate, deviate.

Trust your instincts, tennis is simpler than what you've been told. I grant you it can be difficult to do because it requires both physical and mental exertion and you repeat things over and over again within changing circumstances, but it's simpler to do than what you've been told.

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Tennis is not rocket science.  
Video simply shows you a look.  
Not how it was done or why.  
Video analysts imitate the look or effect.  
And not the principle.

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[Photo credits: Federer, TENNIS magazine, 7/05, AP Photo/Mark J. Terrill; Capriati, TENNIS magazine, 1-2/04, Toru Yamanaka/AFP/Getty Images; Sharapova, LA Times, 6/04/07, Francois Mori/AP; Nadal, TENNIS magazine, 11-12/06, Clive Brunskill/Getty Images; Gonzalez, Inside Tennis, 3/07, Getty Images; Roddick TENNIS magazine, 5/07, Getty Images; Agassi, TENNIS magazine, 5/94, Stephen Szurlej/Tennis Magazine; Federer loose grip, USTA magazine, Sept./Oct. 07, Mary Schilpp, Getty Images.; Nadal two hands, Tennis Magazine, 11-12/07, Clive Brunskill/Getty Images.]

# Revolutionary Tennis

## Tennis Instruction That Makes Sense

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## EVIDENCE

### THE WRIST SNAP ON A SERVE IS REAL, IT IS NOT A "MYTH"

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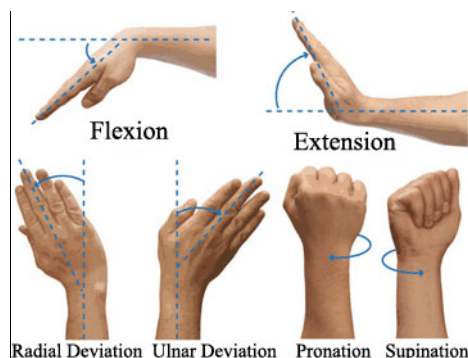
I'm sure you figure you snap your wrist on the serve on purpose and that pros do as well. But you may be confused by either of two pundits and their followers who tell you you're not figuring things out correctly here. One, Vic Braden, claims you and pros aren't snapping the wrist but only pronate the arm and hand; the other, John Yandell, says wrist movements are "passive," "not a causative factor" in power and spin, and that the wrist moves merely because it is "along for the ride" due to the movement of larger muscle groups or body parts. Both groups call the wrist snap "a myth."

This point of view is nothing short of ridiculous. **Revolutionary Tennis** says you're the one figuring things out right. And now clear scientific evidence disproving these pundits exists and can not be ignored.

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## TENNIS IS SIMPLE TO UNDERSTAND THOUGH ADMITTEDLY HARD TO DO

A former teaching pro-now-Ph.D. candidate Brian Gordon in a series of articles researching "power" on a serve has published on the question whether the wrist moves voluntarily/consciously as a result of a muscle contraction on a serve ("wrist snap"), or whether the wrist moves involuntary because it is "along for the ride". This series of scientific articles ironically are showcased on Yandell's prominent web site which screams "the "wrist snap" "is a myth" in his article, "The Myth of The Wrist: The Serve." I stumbled onto Gordon's "The Serve and Tennis Science" by an email blast from the USPTA, I never would have found it trolling the site.



Is wrist movement a conscious thing, known as a muscle-driven joint torque, or is it involuntary, known as a motion-dependent torque because other body parts are moving? Pundits only claim the one, but Brian Gordon found both: He also found wrist movements to be conscious. What pros call a wrist snap is causative, active, purposeful.

## Strike One.

These science papers on the serve show this voluntary, conscious wrist movement on the serve is also responsible for racket head speed. Since racket head speed leads to power this eviscerates the much narrower argument "the wrist snap *for power* is a myth."

## Strike Two.

Brian Gordon's "The Serve and Tennis Science" clearly shows the % contribution of wrist movement on a serve, a.k.a. extension, deviation, flexion. The numbers show the wrist contributes second in global usage only to the twisting of the trunk, yet ahead of elbow extension, shoulder movement, upper arm twist and forearm pronation. Clearly the wrist is doing *something*.

## And Strike Three.

There's much too much going on with the wrist to think it works as an afterthought, uncontrollably. There are 6 papers Brian Gordon has written: "The Serve Wind Up," "Upward Swing Part 1 and Part 2," "The Serve Back Swing: The Upper Body," "The Backswing: Part 1," and "The Serve and Tennis Science." And more to come, no doubt.

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Now for the facts.

Brian Gordon based his technique from other researchers who had studied various body segment motions from volleyball and tennis. He did his own expanded analysis and studied "nine NCAA Division I players, measuring how the motion of each segment of the body contributed to the speed of the racquet head."

He broke this down into 5 body segments.

1. Legs
2. Trunk
3. Hitting upper arm
4. Hitting forearm
5. Hitting hand/racquet

He determined "the contribution from each segment (or associated joint action) every 1/100 second from the racquet low point to just prior to contact," and he "summarized the results at three key points in the motion." These three key points are:

- A. The racquet low point
- B. Half-way between the low point and contact, called the mid-point
- C. Just prior to contact (1/100 second before)

I have taken the % values from each of the 3 key points in the motion (A, B, C) and listed them in order to give an overall look at the percentage contributions of each of the 5 body segments. The author emailed me to say he did not do this on purpose because they are "instantaneous contributions which may, and do, have negative impacts in other parts of the swing" and because "assigning overall contribution (or combining different rotations at a joint like the wrist) can



over-state or under-state their global importance and de-emphasizes the processes by which these contributors are integrated and prepared - in my opinion - however I provide the data so readers can draw their own conclusions."

It turns out the twisting of the trunk had an aggregate 27% involvement in the serve over these three key points in the motion, and the wrist was second with 24%.

So draw your own conclusion, see how this lays out for yourself. You will note some values at a particular point add up to more than 100%, and it is "because other segment motions contributed negatively [and] that a negative contribution may be necessary for a segment to correctly position itself or to contribute to the positioning of other adjacent segments."

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### Twisting of Trunk

rax low point

A. 50% (28% hips; 22% shoulders)

mid-point

B 22% (11% hips; 11% shoulders)

just before hit

C. 10% (-3% hips; 13% shoulders)

**total: 82% of 300% = 27.33%  
usage throughout**

### Wrist

rax low point

**A. 29% Extension**

mid-point

**B. 18% Deviation**

just before hit

**C. 24% Flexion**

**total: 71% of 300% = 23.66%  
usage throughout**

Twisting of Trunk seems to me just that, and from reading Brian Gordon's paper you do the archer's bow, you lean back a bit, all in the name of developing forward angular momentum.

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### Elbow Extension

mid-point

B. 29%

just before hit

C. 35%

**total: 64% of 300% = 21.33%  
usage throughout**

### Shoulder Movement

rax low point

A. 26%

mid-point

B. 24%

**total: 50% of 300% = 16.66%  
usage throughout.**

Shoulder Movement is more complicated. It involves the cartwheel, shoulder abduction (lift the upper arm at the shoulder joint) requiring external shoulder rotation, shoulder joint motion that leads to upward and forward upper arm movement. External, then internal shoulder flexibility is the holy grail here.



### Upper Arm Twist

max low point

A. 26% (external rotation)

just before hit

C. 17% (internal rotation)

total: 43% of 300% = 14.33%  
usage throughout

### Forearm Pronation

max low point

C. 5%

total: 5% of 300% = 01.66%  
usage throughout

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**"And indeed, wrist flexion is a major contributor to racquet speed near and at contact. The significant portion of this flexion is caused by active and conscious muscular contraction and associated joint torque." ["Upward Swing Part 2"]**

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Throughout his expanded analysis Brian Gordon points out that while people studying this "don't as yet fully understand the origins of all the joint forces," and that "every player will use his own combination of muscular contraction (joint torque) and joint forces (motion dependent torque) to rotate the segments of the hitting arm," he nevertheless states there is active, conscious movement of the wrist by muscular contraction.

Mr. Gordon's work reads as a sincere, honest effort and is to be commended, he is one of the good guys. But forget about looking at the wrist snap within the narrow context of only power or racket head speed, these are red herrings because the wrist is involved in so much more. The use of the wrist is directly related to the spin on the ball, to the upward swing path, to the swing pattern, to the racket position at the end of the drop. And all of this stuff prior to contact is a conscious effort. The icing on the cake is the *conscious* nuclear pop at the end.

There are indeed more strikes to be called against those shouting "myth" because it is intellectually dishonest and professionally irresponsible to claim an either/or, black/white scenario of what dominates kinetic contribution at a joint: *only* a muscle driven joint torque or *only* a motion depended torque? That is, if a motion dependent effect is dominant it should not be interpreted as a lack of conscious contraction, and vice versa, because both will be present, both will contribute (as the author indicated to me). Furthermore, there is a lot of crosstalk going on between relaxation and contraction and of allowing motion dependent effects to occur, issues that science now admits it knows little of but of which athletes are aware and amateur analysts can not imagine.

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**Let's be clear: you snap your wrist. On purpose.  
3-dimensionally, not in a bye-bye motion.**

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You do snap your wrist on purpose, this snap does contribute to power, but you can't get a powerful serve by only snapping your wrist. To have more power and avoid injury you use more of your body and I think you know that because tennis players are a smart, independent bunch. And like Brian Gordon, those offering tennis instruction need to speak up to tennis players.

Now when does this "wrist snap" happen within the symphony of moving body parts? At the last millisecond right before you hit the ball? At the moment you hit the ball? Is it a last ditch effort? Of course not, you know that, it happens very much before you ever hit the ball, like turning the wheels of your car before you're in the middle of the curve. If you bring your racket head uP to the ball and "snap" the moment you hit you merely hit down on the ball.

What pros call "snapping the wrist" is a process that begins much earlier than right before the moment you hit the ball. You don't reach up to the ball with the racket and then consciously snap the wrist at contact, by then it comes to the party too late.

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Perhaps the rub is that our tennis pundits view only **contraction** as "the" conscious muscle effort whereas athletes and true Biomechanics scientists also know **relaxation** to be conscious effort. Being able to relax the hand and wrist allows one to train the arm to perform its myriad operations in a serve, allows the racket to be placed optimally during the swing path, and ultimately sets the stage for the wrist to jump through its hoops when required. If you tense up the wrist this can not happen.

Mr. Gordon notes, "During the mid portion of the upward swing, wrist ulnar deviation takes over as the most important wrist contributor to racquet speed....This ulnar deviation is not caused by conscious contraction. It is driven primarily by joint forces and their motion dependent effects." To allow for wrist ulnar deviation material to "racquet speed" to be "driven primarily by joint forces and their motion dependent effects" means the wrist and hand can not be rigid. Thus the sound advice of a loose grip, spaghetti arm, etc., on the serve, advice that is heeded consciously throughout the swing.

Contraction of the wrist is most pronounced when flexing, not deviating, thus the difficulty in measuring how much contraction is associated with deviation. Even if you choose to argue a zero contraction effort associated with ulnar deviation nevertheless a relaxation effort *is* associated with it. And this is done purposely.

As you're bringing the butt cap uP to the ball your consciously loose/extended/radially-deviated wrist begins the process of "snapping." The now-documented conscious flexion that "is a major contributor to racquet head speed near and at contact" shows the climax of a process that began first with a loose grip and spaghetti arm, then added radial deviation and extension at the low point and then ulnar deviation in the mid portion of the upward swing.

### **AVOIDING THE DEADLY WAITER'S TRAY POSITION**

**Relaxation** is an integral part of an athlete's execution, it is done purposely as a conscious effort. Rebecca Soni of USC in an upset won gold in the 200 breaststroke in the 2008 Beijing Olympics and said, "It just kind of flowed. It just kind of happened. It felt great. I just tried to stay relaxed and not rush through the water and keep my stroke strong, and just power it through the end." This can also be said of our serve: you will flow, it kind of happens, and we try to stay relaxed, not rush through the body set-up and swing path, keep the body strong and then power it uP to the ball and go nuclear with the wrist at the end.

The student who loads the body can not get the snap unless the wrist is used in a particular manner or is allowed to be used in a particular manner prior to dropping the racket down behind the back; the student who does not place the wrist in the proper lift-off scheme prior to swinging uP will not enjoy the proper uPward swing path; the student who can not relax the wrist and allow for wrist radial deviation before and while swinging (the butt cap) uP will not only succumb to the deadly waiter's tray position but also fail to enjoy the tail-of-the-whip effect the wrist can apply at the end.

[Sampras sequence, second column from left, shows this wrist radial deviation occurring, and it occurs only as a result of having learned to do it and not because the elbow

pops up. The elbow pops up not on its own, it pops up because of what the hand is doing at this point. The elbow is not the trigger for the hand/wrist, the hand/wrist movement is the trigger for the elbow.]



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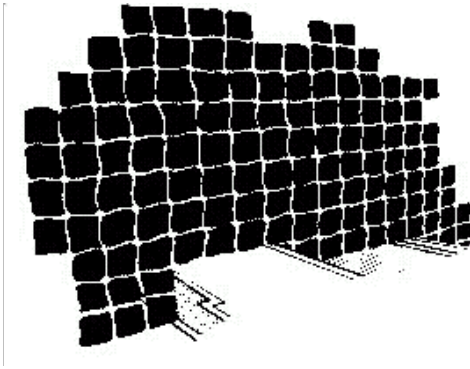
So there we have it, you've been right all along. There is a wrist snap, or a snap of the wrist, and it's done on purpose; it is real, it is added to the pronating arm and hand. Tennis is simple to understand, though it can be hard to do per your wants and desires. Temper those desires a bit, i.e. relax, and you'll surprise yourself by doing better than expected.

**TRUST YOUR INSTINCTS. REFUTE HEGEMONY.  
FREEDOM.**



# Revolutionary Tennis

## Tennis Instruction That Makes Sense



On Linear Momentum and Angular Momentum

The debate? The misunderstanding?

The misapplication?

**What is the big deal?**

© Mark Papas  
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I have written in **Revolutionary Tennis** linear momentum is our main source of body momentum to empower/support the stroke, and that angular momentum, a.k.a. body rotation, is counterproductive to a tennis player's success. This proposition raises a lot of eyebrows because pros, organizations, celebrities, and self-styled elites love to point out that it is angular momentum out of the semi-open and open stances, that is body rotation generated by the legs, hips, shoulders, that leads to racket acceleration, or power.

Well, would you like to know that loading on the back leg is called “horizontal **linear momentum**,” and that the leg drive upward off the back leg is called “vertical **linear momentum**,” and that its push forward is called “horizontal **linear momentum**”? I kid you not, as outlined below in a USTA High Performance Newsletter to Coaches that ironically is not offered on their web site either for review or download. And I wonder why not. Possibly because of the confusion it engenders, the many unanswered questions it raises.

Here it is. But quickly first....

This all begs the question: IF leg drive (vertical and horizontal **linear momentum**) is “critical for ... and the development of high racket speed” why do the authors say “significant rotation” of “hips [and] shoulders” in the photos is “indicating a powerful stroke”? This is terribly misleading because what players take out of all of this is to enact “significant rotation” of their bodies to develop a powerful stroke, and if you've tried this I'm sure it leaves you frustrated. A better question to investigate is why and how does this linear momentum set the table that leads to the “powerful stroke,” and whether or not it, and not the opening of hips/shoulder, is primary for power and stroke consistency.

In other words, if I have leg drive do I get the powerful stroke? Or if I do not have leg drive do I get the powerful stroke only by rotation?

From the USTA's High Performance Coaching, The Newsletter for Tennis Coaches, Vol. 9, No.3. Comments in **red** are **Revolutionary Tennis**.

### Linear and Angular Momentum

by **E. Paul Roetert, Ph.D.**, Managing Director Coaching Education and Sport Science,  
and **Machar Reid, Ph.D.**, Manager, Sport Science, Tennis Australia

In the modern tennis game, we see strokes hit from seemingly impossible positions with incredible pace. Players appear to be bigger, stronger and faster than ever, and they hit powerful strokes from any position on the court.

Along with the fact that we are attracting some great athletes to the game of tennis, racket technology has improved significantly. Both of these factors allow players to hit ground strokes with open stances, providing for powerful strokes and rapid recovery. The photo series featured here shows the open stance forehands of Andy Murray and Jo-Wilfried Tsonga. The goal of this photo series is to show you the contribution of both linear and angular momentum in each of these forehands. There are two key things to remember related to these shots:

1. Open stances are situation specific.
2. All ground strokes require both linear and angular momentum.

### Linear and Angular Momentum

The forehand ground strokes featured here are hit with an open stance. One of the main reasons the players are able to use an open stance is that, although they are just inside the baseline, they have plenty of time to set up. If the incoming ball was lower and shorter, each of these players would have "squared off" his forehand significantly. Both players are clearly looking to go on the offensive and are in the process of hitting a very aggressive shot. As you will see in the explanation of the stages of these strokes, there is a significant linear AND angular momentum contribution in each of the forehands. Linear momentum is a product of both mass and velocity and can be generated in both a vertical and a horizontal direction. Angular momentum refers to the rotational component of the stroke and takes into account both the moment of inertia about an axis (resistance to rotation about that axis) and the angular velocity about that axis. Without getting too technical, it is important to realize that both linear and angular momentum are fundamental for the successful generation of power in the forehand. The amount of linear momentum created affects the amount of rotation force that's generated about each of the body segments (angular momentum) and vice versa. Therefore, both play an integral role in the success of the ground strokes regardless of stance. As linear momentum is developed in a straight line and angular momentum about an axis of rotation, coaches often associate a square stance with the former and an open stance with the latter. Conceptually, this link makes sense and may assist with one's understanding of the terms; however, stroke production - regardless of stance - relies on both linear and angular momentum.

**Let's take a look at how these two players employ both linear and angular momentum to their open stance forehand strokes.**

### Preparation phase

In the first three pictures, we can clearly see that both Andy Murray and Jo-Wilfried Tsonga are looking to hit a very aggressive forehand. They are clearly inside the baseline and preparing to hit with an open stance. From Photo 1 to Photo 2, you can see the weight transfer from the left leg to the right leg. This weight transfer shows the horizontal linear momentum necessary to plant the right foot. [i.e. "Loading" on the outside or back leg is horizontal linear momentum.] Even though the linear momentum is in the opposite direction of the stroke, it is important to load the right leg. This helps to prepare the leg for its drive, predominantly upward (vertical linear momentum) but also forward (horizontal linear momentum). This leg drive (or triple joint extension: ankle, knee and hip), which utilizes ground reaction forces, is critical for linear to angular momentum transfer and the development of high racket speed. [The potential for "high racket speed" is present with this leg drive but does not guarantee said "high





racket speed” will happen. Calling this leg drive “critical” to “transfer... linear to angular momentum” inevitably leads one to think more leg drive will be better, but it’s not because you’ll look like popcorn popping.] Photo 3 shows it beginning to unfold, with mostly vertical linear momentum being produced. The subtle differences in the right (and left) foot plant of the two players (Photo 2) offers some explanation for the more pronounced leg drive used by Tsonga (as evidenced in Photos 4-6). Note the amount of both hip and shoulder rotation. The shoulders are typically rotated more than the hips by about 20 degree, which is observable in the strokes of both players (Photo 3). This is commonly referred to as the separation angle.

### Contact phase

The vertical linear momentum phase as been completed, evidenced by the full knee and hip extension in Photo 4. [Only vertical linear momentum, or upward? What about horizontal linear momentum, the forward component, is it present here or not?] Forces have been transferred and we can see the hips opening up first, followed by the shoulders. [Therefore, in the graph above, “leg drive... is critical for linear to angular momentum transfer and the development of high racket speed,” the word “transfer” means it’s done through the “hips opening up first, followed by the shoulders”] Both players show significant rotation indicating a powerful stroke, further evidenced by the right foot coming off the ground (Photo 5). This is where angular momentum (of the trunk and then the rotating upper limb) contributes significantly to the speed of the shot. At contact, the resultant high swing speed (and linear momentum) of both players' rackets allows the linear momentum of the incoming ball to be easily overcome.



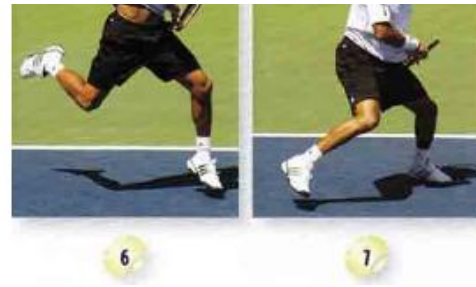
### Follow-through phase

Photo 6 and 7 show the completion of the stroke. The amount of rotation (note how far the right leg comes around) points to the effectiveness with which both players coordinated the linear and/or angular contribution of each of the body parts involved. [Does this mean more “amount of rotation,” and more “right leg comes around” = more effectiveness? No, the “effectiveness” of said coordination lies in the ball staying in, the work-to-result ratio not tilted too much toward work, and the player looks balanced and coordinated regardless of form used.] The fact that both players are farther in the court than at the beginning of the swing (see the position of the right shoulder) is a product of the shot's horizontal linear momentum. The follow-through is also dictated by the differences in objectives (Tsonga hitting inside out



and Murray hitting cross-court). The interplay of linear and angular momentum is what makes the forehands so successful.

End.



## Breakdown

How many times linear and angular are mentioned, including the headers:

23 linear

16 angular

### Problem 1

Leg drive = vertical (upward), and horizontal (forward) linear momentum.

Leg drive = "critical" for linear to angular transfer and the development of racket head speed.

Transfer = hips and shoulders opening, or rotating.

Note is says AND the development of high racket speed, not FOR the development of high racket speed. Therefore the opening of the hips and shoulders, the torso rotating, is not in and of itself "critical" for the development of racket head speed.

But then: "Both players show significant rotation indicating a powerful stroke." We now return to rotation ("significant") as the nexus of the powerful stroke. In other words rotation, not leg drive. So which one is it?

### Problem 2

If you say leg drive is "critical" then players do too much and look like popcorn popping.

You say "significant rotation" = indicates "a powerful stroke" then players do too much and become spinning tops.

Leg drive (linear) is "critical" for the development of high racket speed, but only as long as the transfer from linear to angular results. This transfer, as indicated in the USTA newsletter, is about the hips and shoulders opening, the torso rotating, but this USTA newsletter does not address how much the hips open, how much the shoulders open, whether or not they do so in tandem, what is their objective, how much opening is required to achieve maximum acceleration with maximum torque, and whether or not opening the body helps or hinders the linear momentum of the stroke itself.

Just how does leg drive feed the angular momentum that follows? How can angular momentum be disciplined so it does not destroy the entire process and the player lose control over the contact moment?

What happens when you drive your car as fast as it can go? You lose control, and the same thing happens when we boost angular momentum for the stroke. It's easily seen in golf where, even though the ball lies motionless, large twisting or body rotation to try to accelerate the club leads to lack of contact control. In tennis we move to the ball, linear momentum, load weight and shift weight, linear momentum, and it is **then** we engage "the" power source (angular momentum) for the stroke? I think not.

So there you have it, a sport which on the one hand talks about the presence of linear momentum throughout the

stroking process but highlights the “powerful stroke” coming from angular momentum of hip and shoulder rotation. Or if you want to prevaricate by saying it is the “transfer” from linear to angular that creates the powerful stroke, they why not explain how to mitigate, modulate, manage, or master this transfer other than saying “leg drive” is “critical” and “significatn rotation [indicates] a powerful stroke”?

**Revolutionary Tennis** has stated body rotation will appear on its own without any teacher’s input because it is a natural thing, and that if the teacher asks for hip/shoulder “turn” and “rotation” the student will certainly do this but unfortunately do too much of it to the point of hurting their stroke’s efficacy. Why? Because this is the simplest instruction set to grab onto. Miss-hits, lousy hit, over-hits, and poor timing are all a result of too much body involvement (body rotation, or angular momentum) during the commission of the stroke.

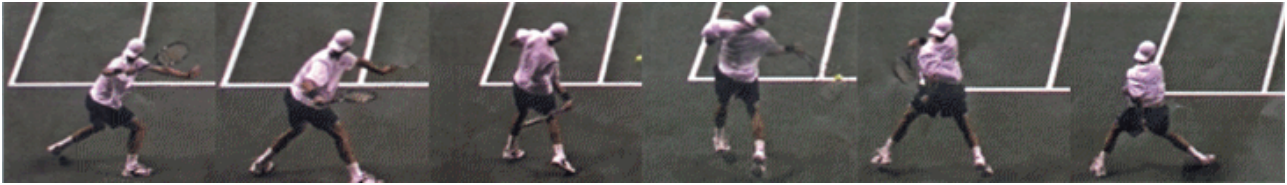
Linear before angular, angular feeds off linear. Because our sport is one where we move. Hence the forward component for every strike: shift body weight forward into the strike, don’t shift weight upward, don’t shift it away from the strike if you really want to get it. Without that you’ll rotate yourself silly and only wind up hurting your body and your game.

Photos below show a forehand groundstroke sequence. From the side we can tell the player did not move forward during the commission of the stroke. She plants her back foot farther ahead than her front, loads, and then instead of pushing forward she pushes up and to the side (to her left). She also winds up jumping left and forward a touch, the back foot ends closer to the baseline, yes, but her effort is primarily up and to her left, putting an awful lot of strain and effort onto her back leg and hip



Here is Roddick from an earlier web page. His forehand return finds him pushing not forward and into the ball but off to his left, though he shows substantial body rotation.





Federer below clearly pushes, or drives himself, forward on a forehand return, and his rotation is much less pronounced for it.



Everyone knows we must “load” body weight to develop a powerful stroke, it’s the expression of athleticism: shift-then-execute. Duh. As in shift and throw the jab, shift and throw or shoot. But the secret lies in unloading our body weight in such a particular way to not adversely effect our swing’s efficacy (arm leverage and elasticity and timing notwithstanding).

Therein lies the Holy Grail to our game, to any athletic expression. The Unloading Principle, and those who do it best are always described as elegant, has nothing to do with the kinetic chain as is commonly written, has nothing to do with overall physical strength though physical strength will improve one’s ability to Unload best, has little to do with the traditional understanding of extending for a greater moment of inertia or engaging more muscle groups. Conventional wisdom talks about one muscle group feeding into another, and a subsequent one feeding off of a preceding group’s contribution, but no one, absolutely no one, talks about how this is done best or what the contributions should be along the way.

**Revolutionary Tennis** will be the first to try to explain how to do it. I will leave the why-ness to the work of scientists and analysts, a pro’s work is the smacking of the ball and communicating same.

Stay tuned. And it’s easier than you’d think. I think I’ll call it the 3-1-2 concept, or Chicago for short. Gotta love the American midwest.

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**S 5: Balance**

**S 11: Returns/Approaches**

**Federer Vision Technique**

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