Step 12

The Serve

Part 5: The Incredible UPness 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

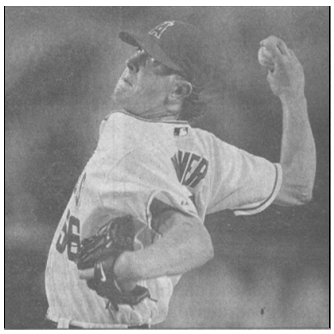
The Sampras sequence below shows this sternum lift-off well because of his shirt's horizontal stripe and the sidelines behind him. First focus on the middle of his shirt, at the gap in the stripe, it starts out as even with the singles sideline and then rises markedly above it, it does not remain in 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.

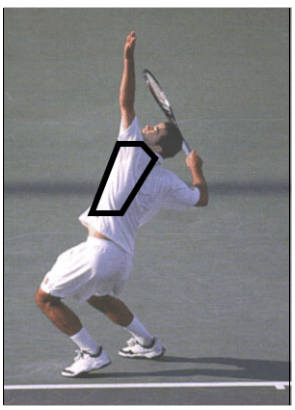
Equally important to help you go up and stay up is using the front half of the body to achieve this. I'm sure scientists can explain better how counterforce enhances the slingshot or arrow delivery ideology, but using the large muscle groups in your chest, abs, and rear shoulder help to produce the Superior Serve.

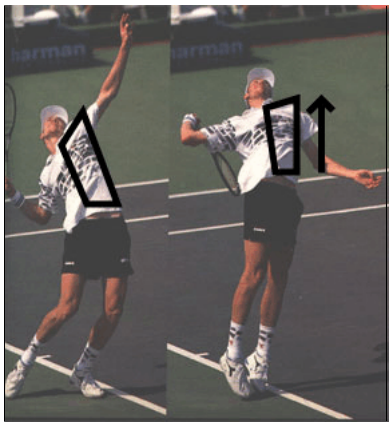
All the photos above can be used to illustrate this concept. Rios and Henman are not keeping the front half of their body up and in on the action as much as Ivanisevic and Philippoussis. I believe Philippoussis achieves this through talent and his overall strength, Ivanisevic through preternatural talent. 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.

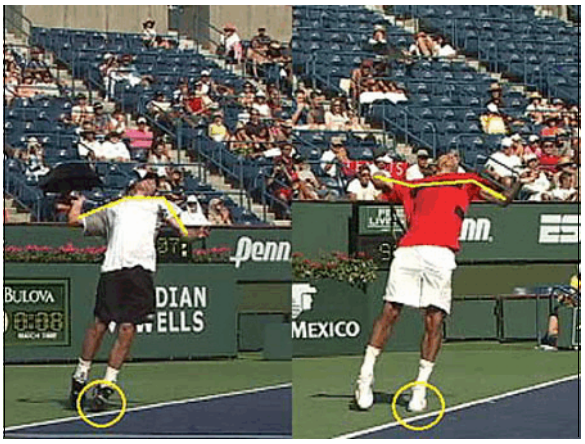
The front half of the body is this: Draw an imaginary line from behind your neck down your spine to your waist then around your waist on your toss arm side and to the front to your belly button, then up the middle of your chest to your collarbone. This is the front half of the body that works to remain up, *independently*, from the rest of you during the swing (outlined in photos on the right of Sampras and Rosset).



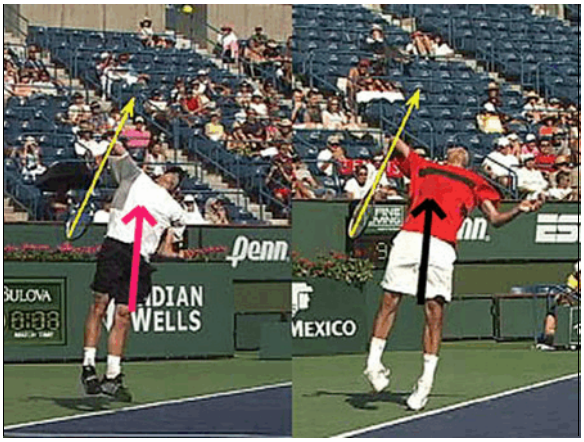


Of course don't forget to keep the toss arm up in all of this, it needs special attention. As Rios shows above keeping the toss arm up helps even if you're not keeping the sternum up during the swing.

A popular website with deep analytical $kills 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 zippo 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.

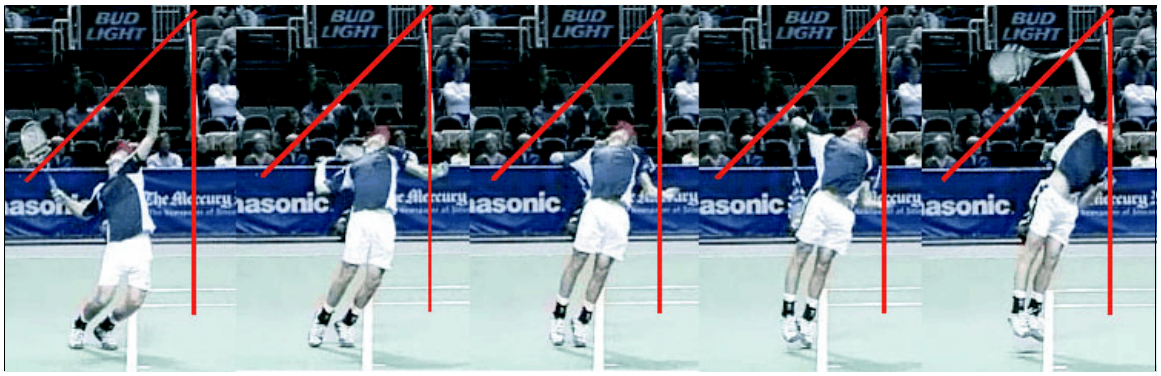


Next photo, same $ite, uses a yellow arrow to show the hitting elbow "pulling up" to the ball as a major component to the stroke. The only way this small body part performs is if something larger leads the way and supports it, as shown by the larger arrows offered by Revolutionary Tennis. You lift from 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]



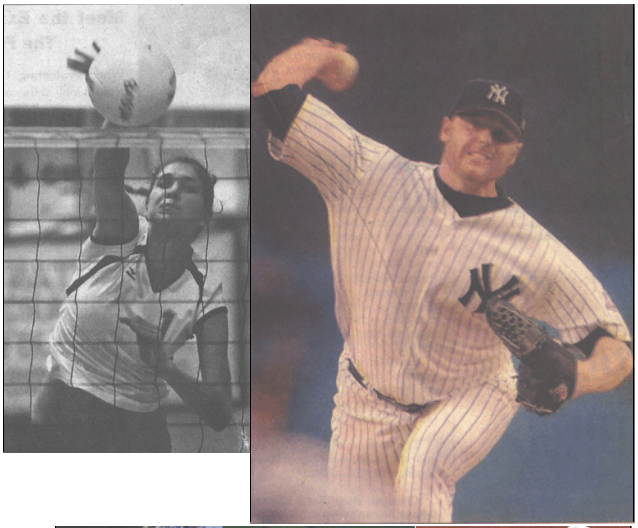
The red line "funnel" over Andy Roddick's serve illustrates this concept. The arm does not swing out wide away from the body but instead moves remarkably up and in -- to the ball. The racket does swing away from the body out of the backscratch and the forearm follows close by, but the earlier mention 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

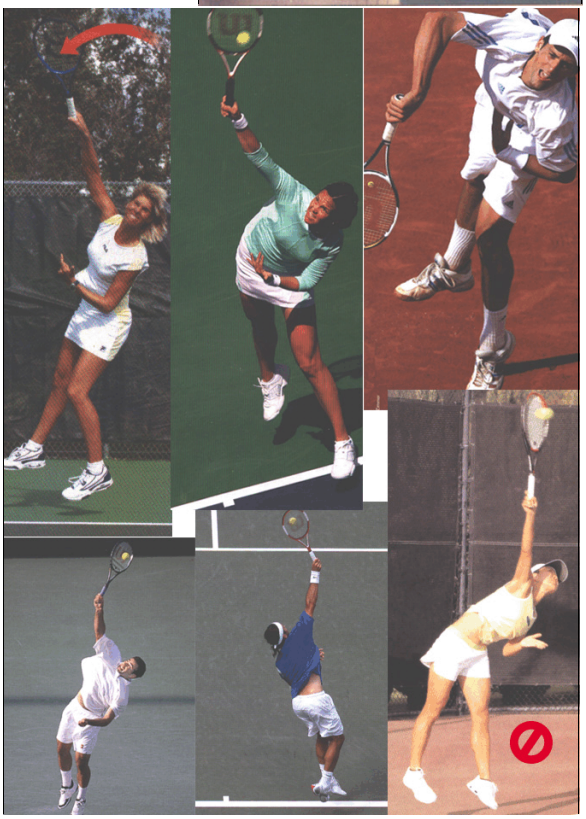
One of the biggest surprises is the idea of remaining turned during contact. The torso needs to fight to remain turned when you swing up to the ball instead of (giving in and) facing the opponent during delivery like baseball pitchers face the batter during their delivery. We fight to stay "turned" (in 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 snot 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.

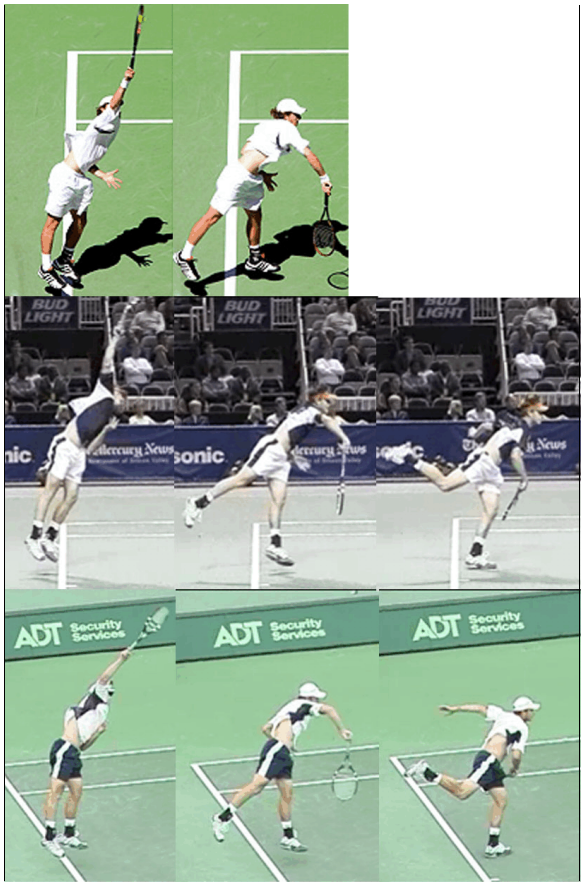
How to do it? It's a byproduct of what has gone before. If your sternum goes up, if you keep the front half of your body up, and if you reach up in the swing it is more than likely - but not guaranteed - you will not open up prematurely.

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.

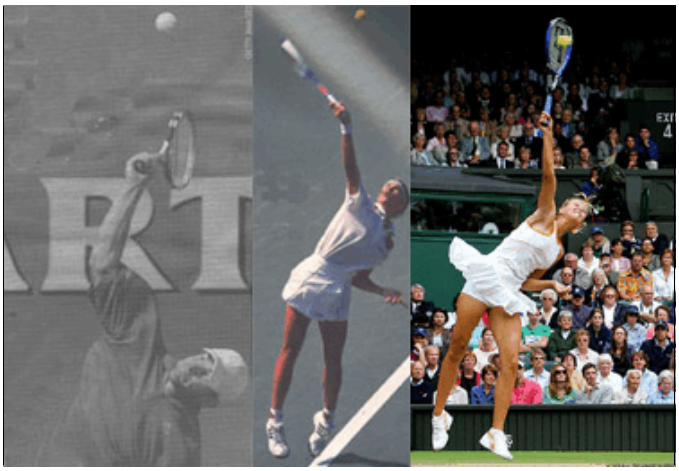
SECRET

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.]

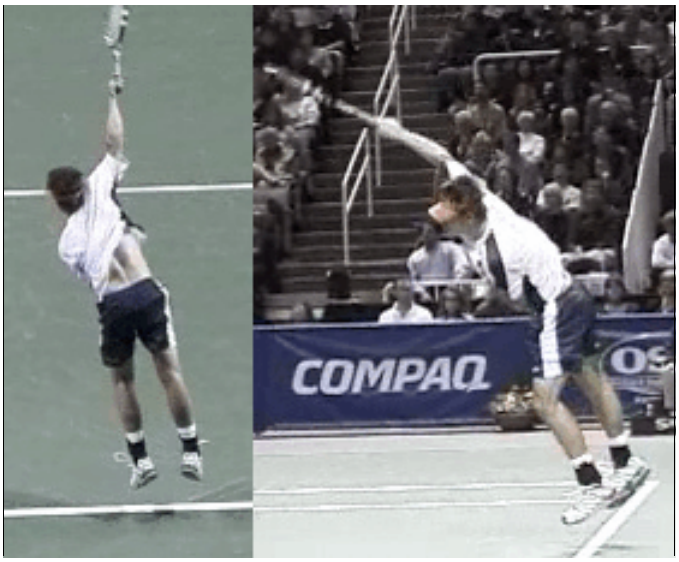
PRONATION... OR WRIST SNAP?

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.

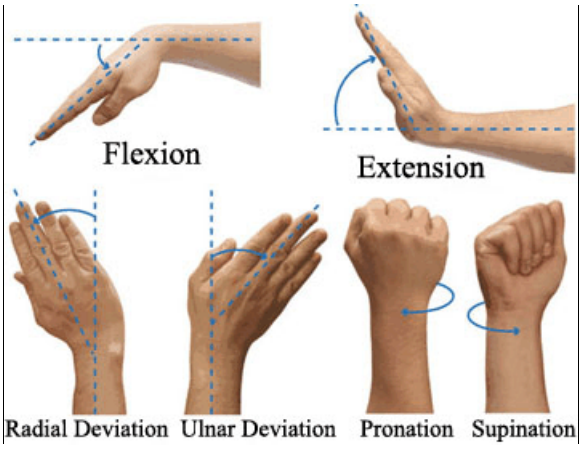


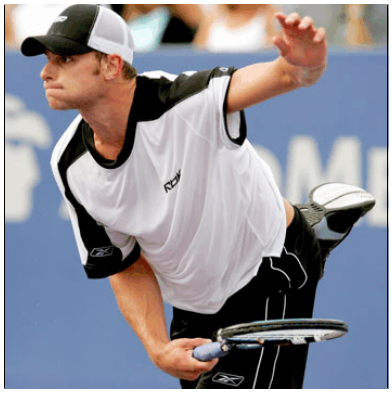
But what does the wrist do? Pros talk wrist snap, scientists/observationists say no such thing occurs. Scientists like to opine, "often what they [pros] say is not what they do." Are the pros wrong?

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.

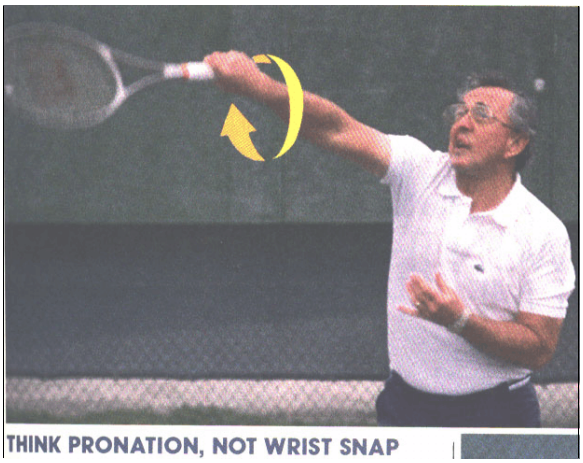




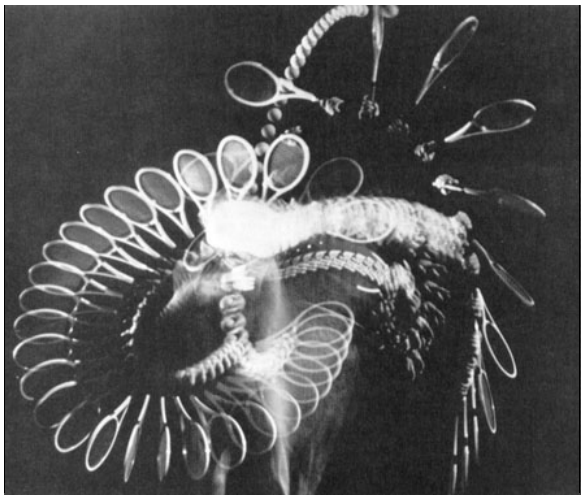
The hand does not bend simply at the wrist. Question becomes for the student:

DO I SNAP MY WRIST OR ONLY PRONATE?

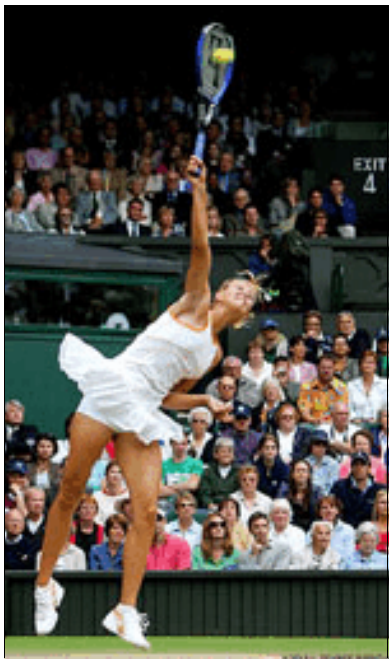
Many self styled tennis scientists look at the film evidence and say, "Aha! The key is to pronate the forearm and hand/wrist!" But the loudest voice out there says you do not snap your wrist. In fact, Vic Braden says his "studies show there is no wrist snap on the serve; anatomically it just does not 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."


THINK PRONATION, NOT WRIST SNAP

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).

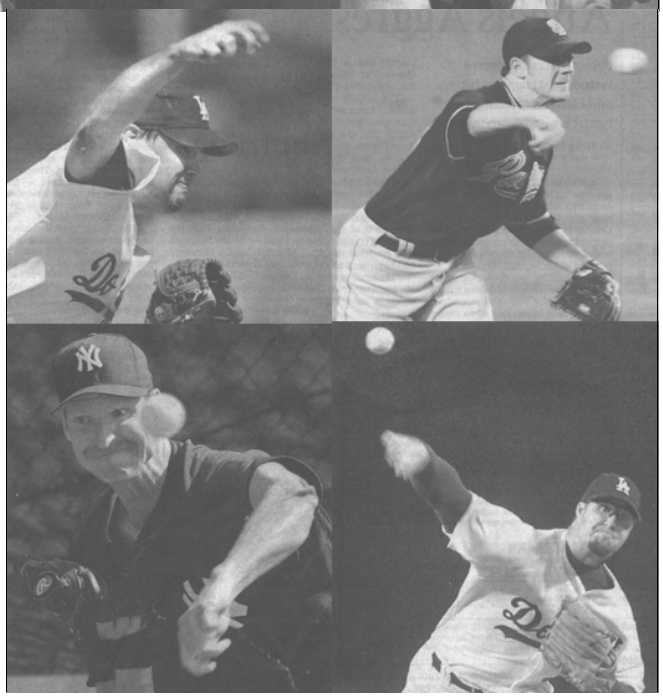


What Vic and others say is high speed photos (Revolutionary Tennis has seen some) show that at impact, and right after, the wrist does not continue moving or bending forward (flexion) but instead pronates, or turns out. The same can be said of a baseball pitch and yet "snap the wrist" is part of their 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 is looks like it does not bend over forward.



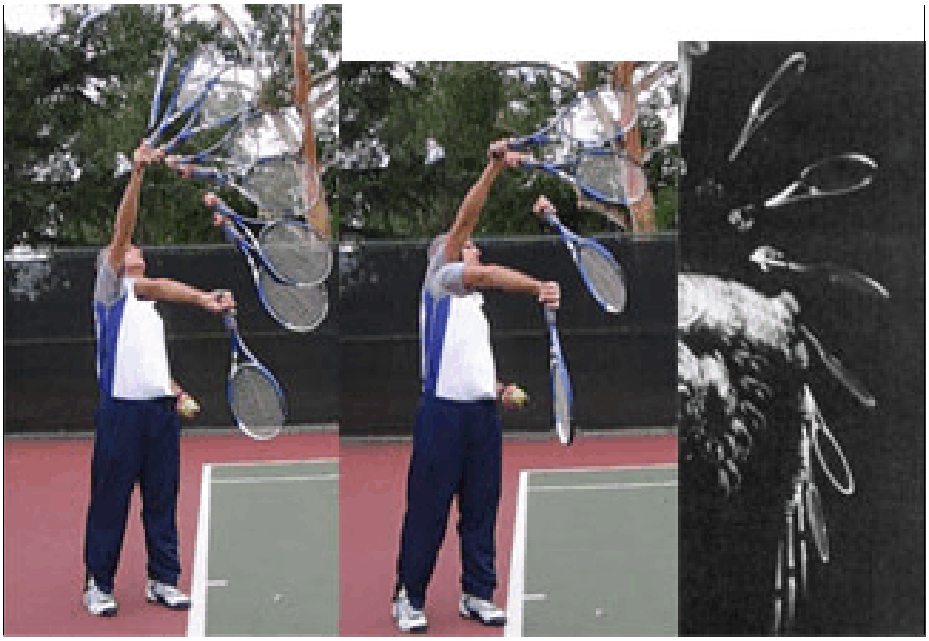
More looks of a pitcher's hand at release and soon thereafter. In the baseball foursome group, Aaron Sele, top left, the wrist seems to be bending forward; pronation is seen in various degrees with Jake Peavy, top right, Eric Gagne. bottom right, Randy Johnson, bottom left. Point is in baseball, regardless 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 3rd 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:

1st	Movement:	Up
2nd	Movement:	Over
3rd	Movement:	Across

For a second serve:

1st	Movement:	Up
2nd	Movement:	Across
3rd	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 is 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.

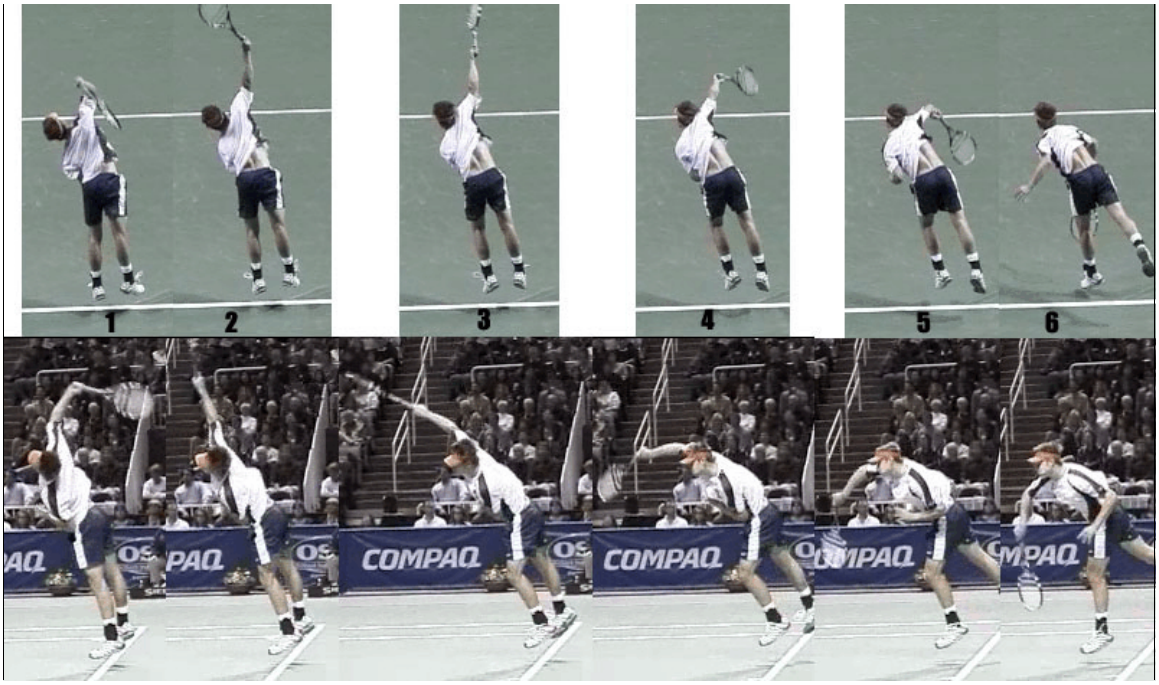
You don't think about using the wrist until the last minute, when it's needed, if you think about it earlier during the swing you wind up shortchanging the swing mechanics needed for success. You have got to hit the other points in the Superior Serve first to be able to go nuclear with the wrist. With 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.

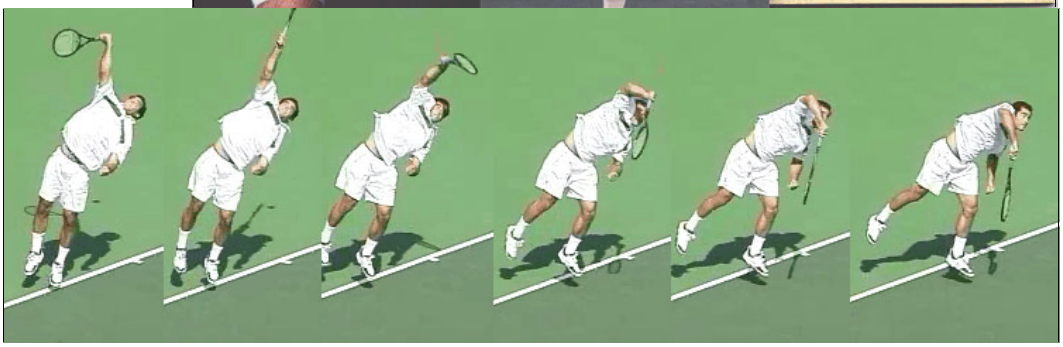
Athletes often are too egotistical and inflexible in helping discover what really goes on with their execution ("I was taught this way, I have always done it this way, this is how I do it"). Good athletes can put their stubbornness and self centeredness on pause for self improvement. Bad ones think they 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.

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