

Revolutionary Tennis

Tennis Instruction That Makes Sense



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.



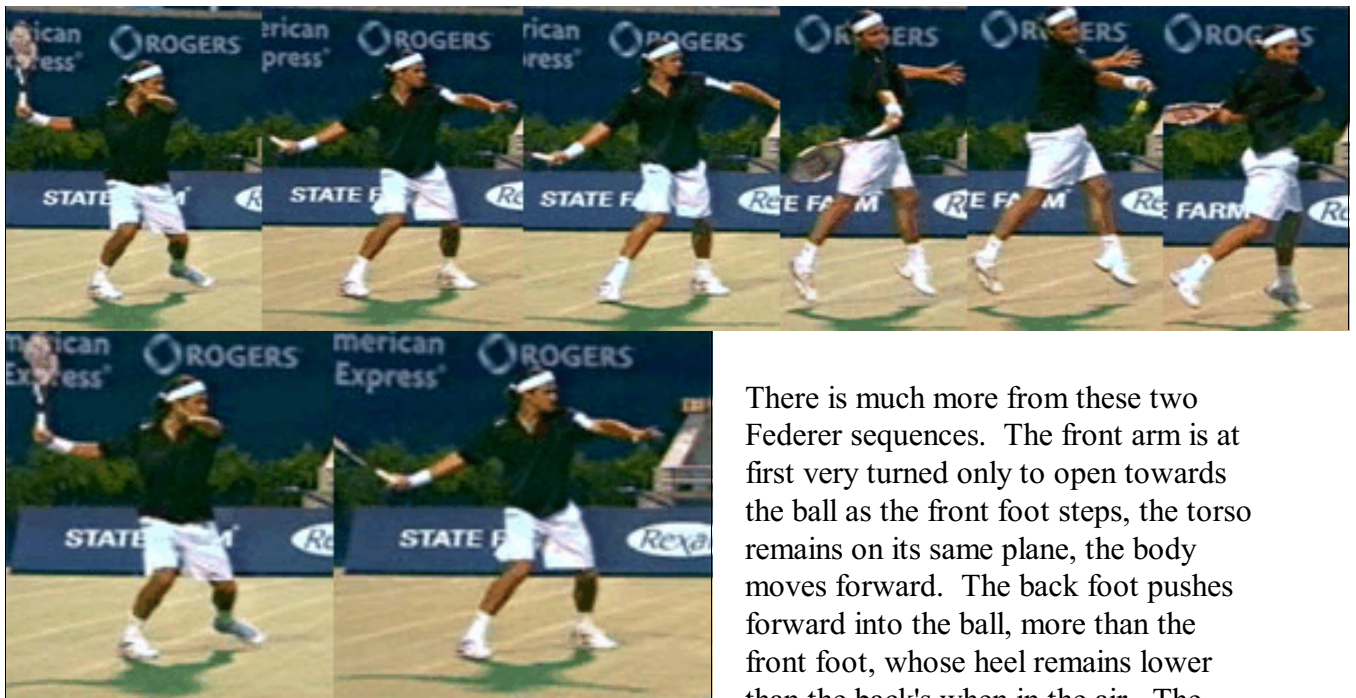
The step-and-hit is a fundamental precisely because it relates to the first of two foundational issues of athleticism: timing (rhythm is second). The foot used for the timing step is the front foot. In the exception the back foot can be used as a timing step but the rhythm and forward momentum will not 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.

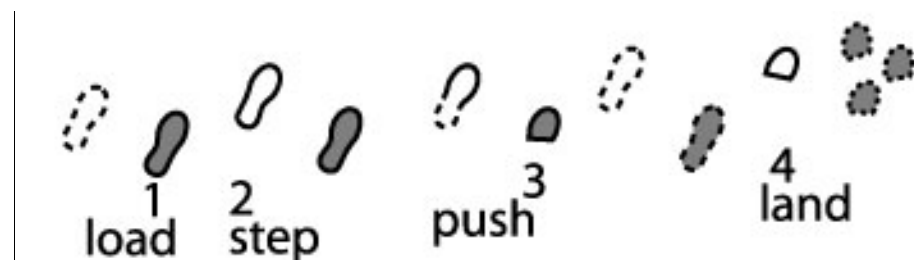
As a larger, more radical theory found throughout **Revolutionary Tennis'** pages, this step-and-hit with the front foot takes advantage of linear momentum, the cornerstone to body-power for a tennis player. As shown by Federer not a lot of it is necessary to empower the stroke, it does not have to be 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

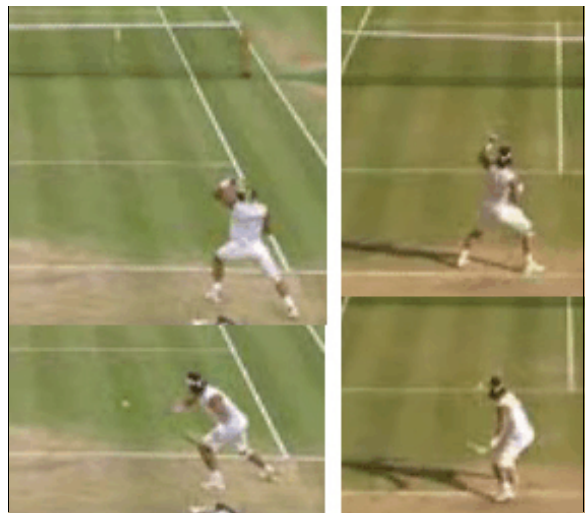
front foot more in front of the back foot when viewed from the side. The body does but a quarter rotational turn into the shot, far less than open stance devotees instruct, because Federer is moving forward into the ball.



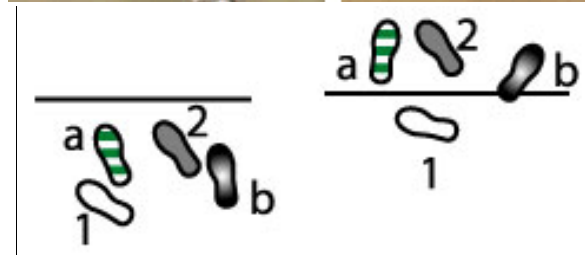
Move to the ball, then load, step, push, land, in semi or open stance. Not the Papas method or "new," forward and step-hit is the mother's milk of tennis.



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."

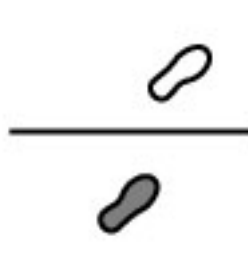
As seen with the Federer examples the "load" step is not the final step but the penultimate one unless braking on the outside leg to hit. The front foot is "the final step in the adjustment" even when held passively out of the way or kept limp up in the air (active adjustment measures).

"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."

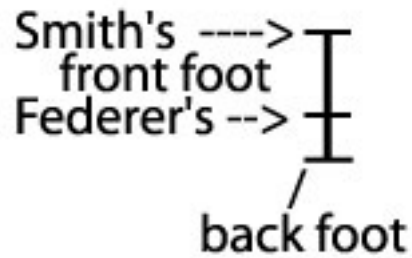
Perhaps trying to reinvent the wheel is doing an injustice to students. But the USTA says the opposite, from their High-Performance Coaching newsletter Vol. 6, No. 4 / 2004:

"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?

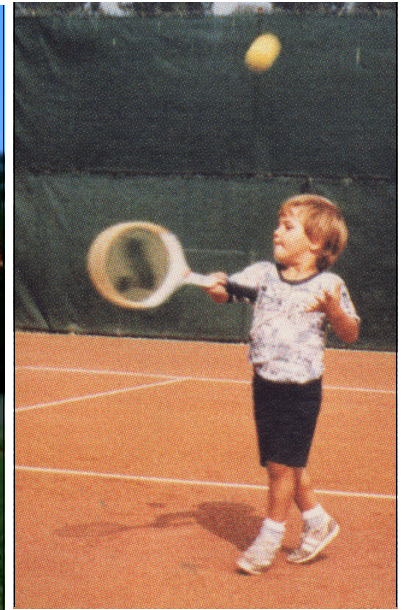


Teaching organizations counsel linear momentum is still there in our shotmaking but that angular momentum is the "new" tennis since it takes advantage of the "kinetic chain [that] is the sequential coordination of body segments (feet, legs, hips, trunk, shoulders, arm and wrist) to achieve more force 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.



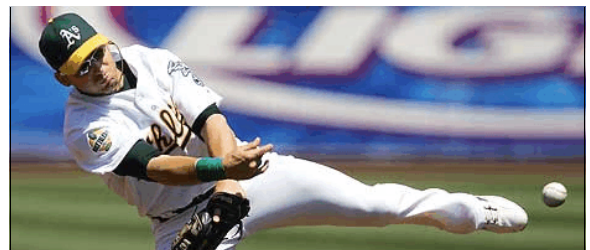
Same for teaching a little one how to play tennis, as shown on the far right. The kid's choking up on an adult racket, using the singular fundamental of step-and-hit, or front foot-contact, and his head's turned off to the side like... That's Federer, by the way, age 3, from the book "The Roger Federer 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.



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".)

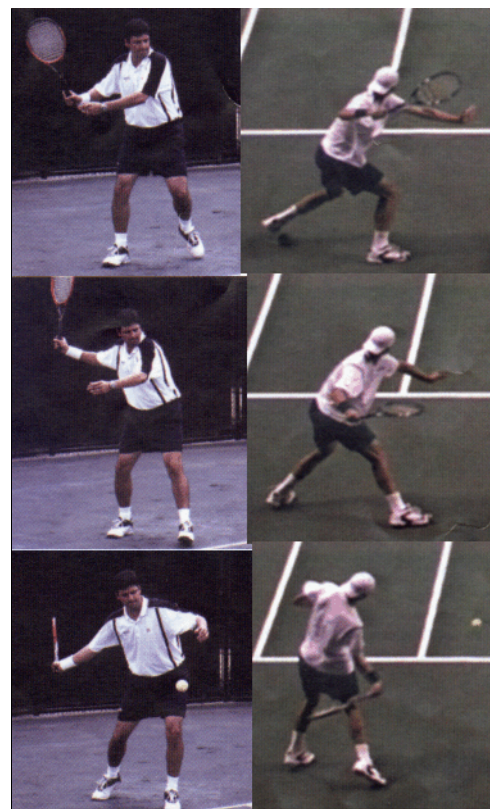
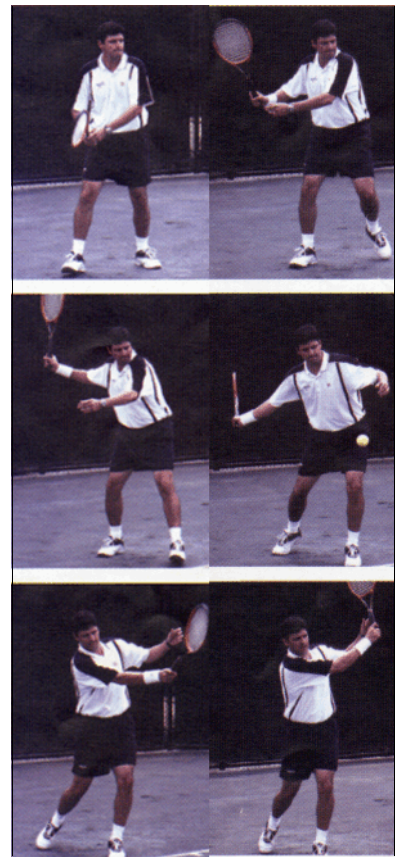
As a junior I noticed players in real-time did not turn-pivot from the ready position because they first moved to the ball, and that before they stepped into the ball to hit their back foot was angled in the "pivot" position. The next-to-last step was "pivot," the last one "step." I figured tennis teaching 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?

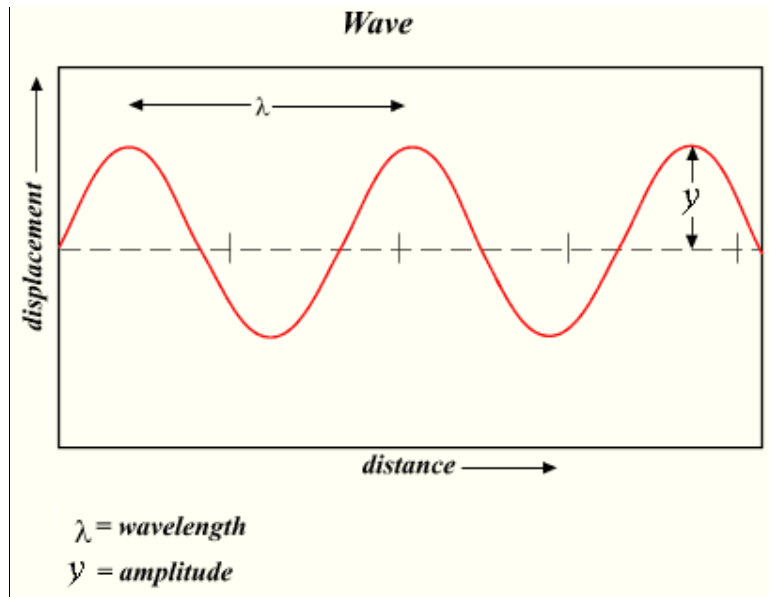


HOW THIS SHORTER STEP WORKS IN THE STEP-HIT a hypothesis

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.

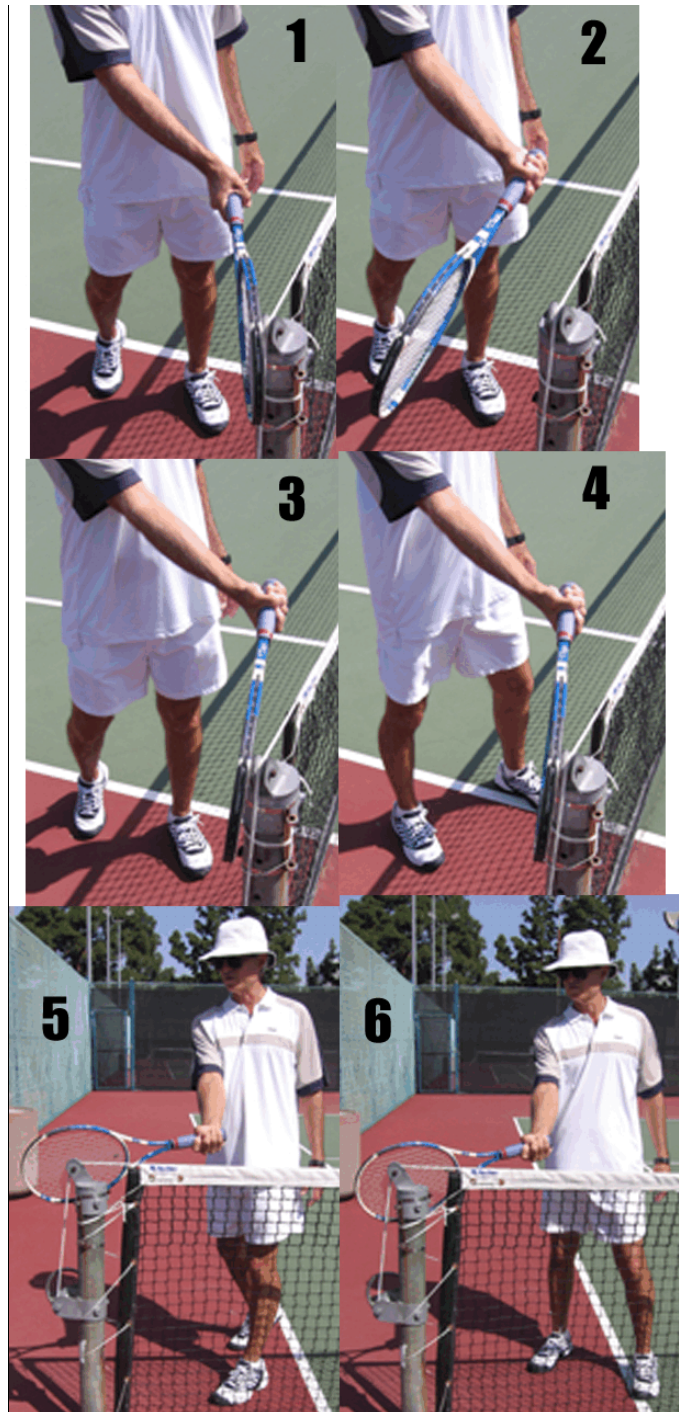
Why the shorter step? Stepping forward into the ball using a Forward or Square Stance with the semi and/or western grips is too uncomfortable to be productive or effective. If it weren't pros would do it and they don't, they open their bodies to get the proper body support (avoid injuries) and hit on 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.

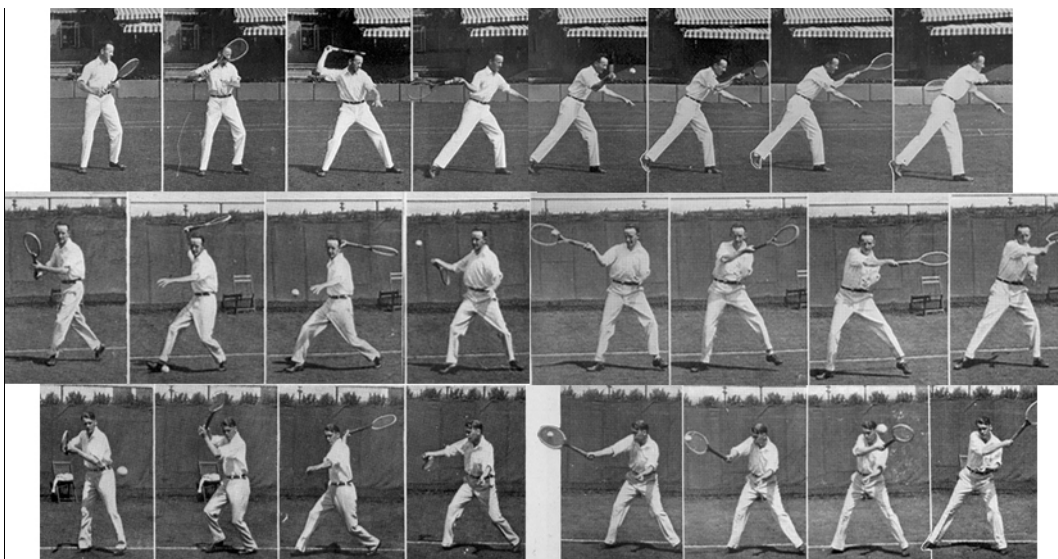
CONTACT VALUE

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 gobbledegook. 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).



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



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.

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)

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.

'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.

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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 racquet 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."

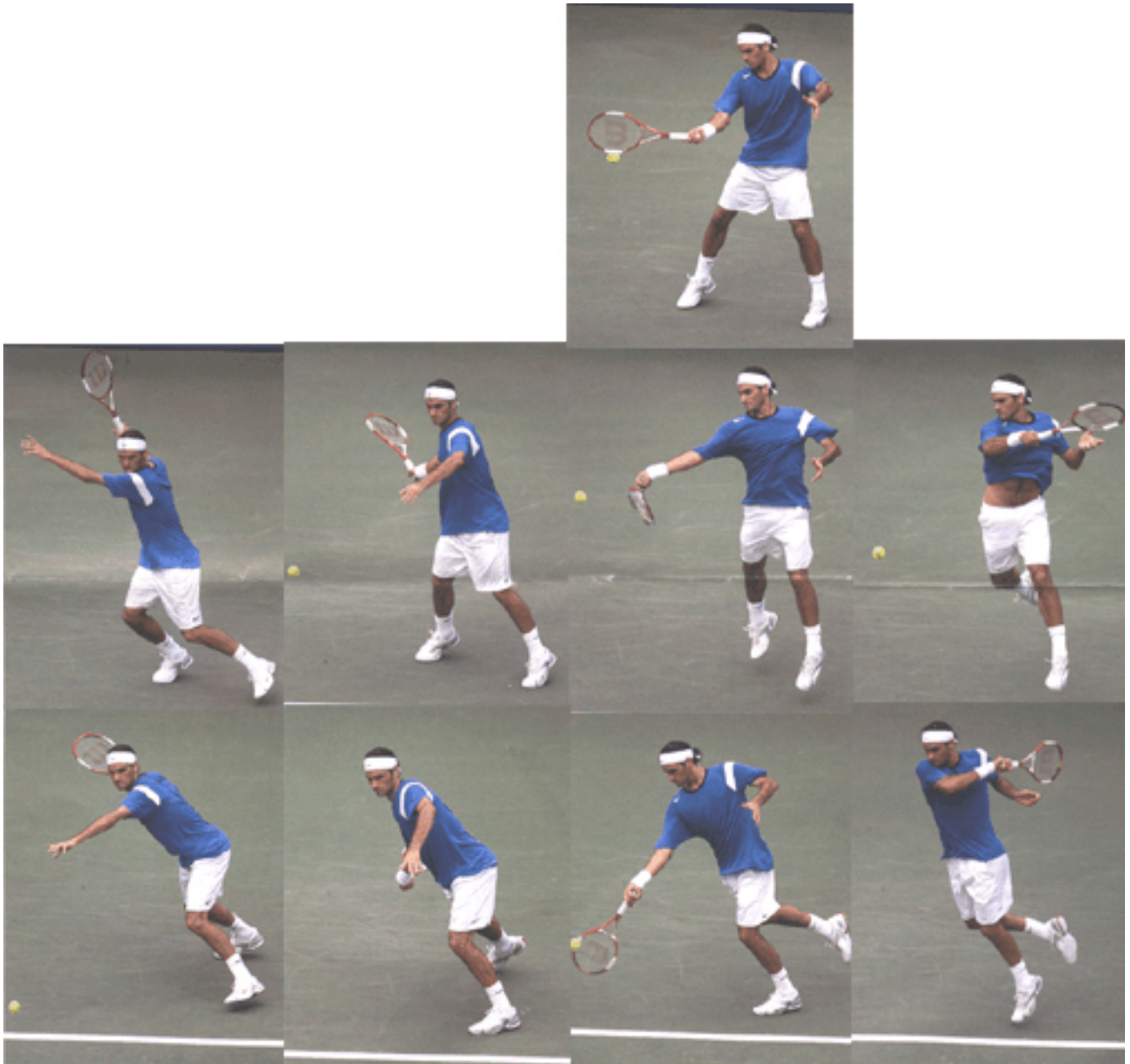
Federer in both stances has the front toe off the ground first and in the top semi-open he step-hits and his back foot pushes forward into the ball (heel off the ground). To say Federer uses only trunk rotation for racket speed in the semi-open stance here simply overlooks what the feet are doing. Hiding 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.

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]