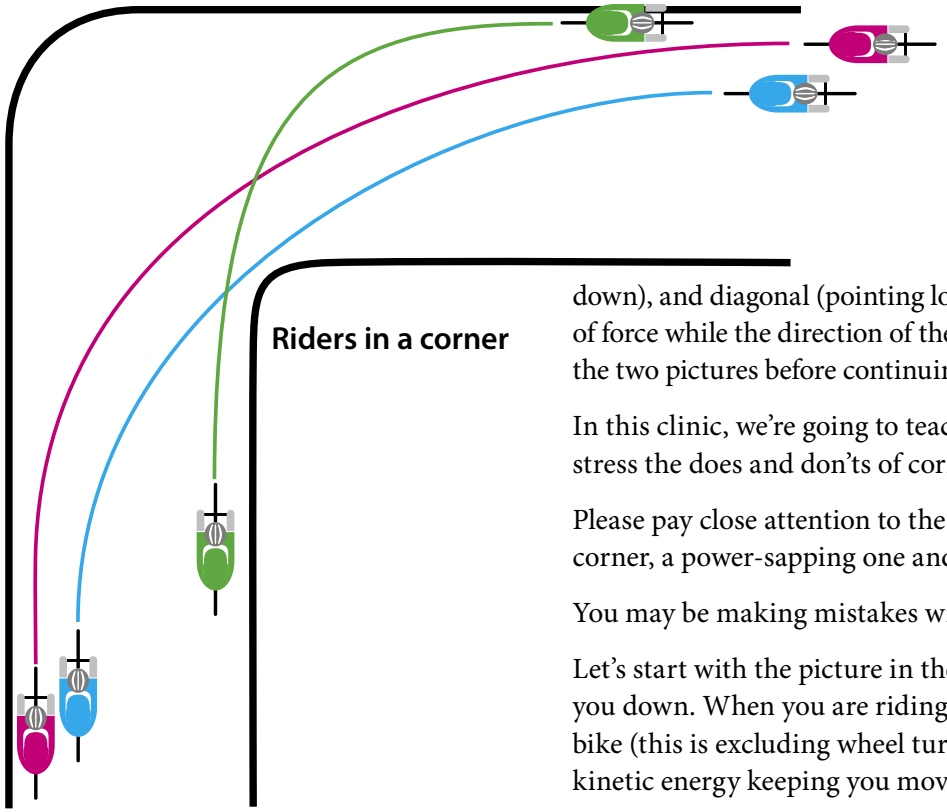
Cornering

from www.coachcarl.com/training_articles/cornering.htm

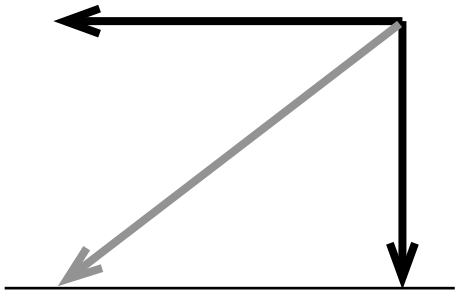
First, take a look at the picture on the left. We will refer to this picture throughout this article.



Riders in a corner

For reference purposes concerning the cornering picture (Riders in Corner), the red cyclist is the one on the far left, the blue cyclist is the one in the middle, the green cyclist is the one on the far right, and the lines represent their lines through the corner.

The picture with the arrows or vectors (Forces When Cornering) is to help you understand the basic forces involved in cornering with the bottom line being the ground or road. We will refer to the horizontal (pointing left), vertical (pointing down), and diagonal (pointing lower left) vectors. Remember that the length of a vector shows the speed or amount of force while the direction of the vector shows the direction of the force or object. Please familiarize yourself with the two pictures before continuing.



Forces when cornering

In this clinic, we're going to teach you a scientific and common sense approach to cornering. We are going to stress the does and don'ts of cornering along with common mistakes commonly seen in cornering.

Please pay close attention to the details; it is the details that makes the difference between an excellently executed corner, a power-sapping one and one that puts you on the pavement.

You may be making mistakes without knowing it and even little mistakes can put you down.

Let's start with the picture in the lower right corner. The vertical vector is representing the force of gravity pulling you down. When you are riding in a straight line on flat ground, there are only two basic forces acting on your bike (this is excluding wheel turn etc.) Those two forces are gravity pulling you down toward the ground and the kinetic energy keeping you moving forward.

In this position, you keep your center of gravity over the centerline of the bike to keep the bike vertical and going in a straight line. If you move your center of gravity to either side of the centerline of the bike, the bike will lean in that direction. If you place a pedal at the bottom of its stroke and place all your weight in that pedal, the leverage of the pedal will cause the bike to lean and turn in that direction.

Most people mistakenly believe that you control the direction of your bike with your handlebars but the truth is that you move your handlebars very little except at very slow speeds when you cannot lean much. You actually control the direction of your bike with your saddle. By causing your saddle to move left, you cause the bike to lean left, which causes your bike to turn left.

You should know this from walking with your bike and only holding it by the saddle. You can make your bike go

Cornering Tips

- Inside pedal up so you don't scrape your pedal across the pavement.
- Coast through the tightest part of the corners so your inside pedal hitting the pavement dosen't lift your bike of the ground and put you on the pavement.
- Inside leg's knee when pointed outwards (into the corner and at an angle to your line of travel) will enable you to take corners faster with greater stability.

where you want by leaning the bike with your saddle. When you are racing, you do the same thing except instead of leaning the bike with your hand, you are leaning it with your center of gravity.

THEREFORE, (and this is a big therefore) the control of your bike during a race is determined by your center of gravity (placement of your weight) in relation to the centerline of the bike. Don't forget that.

At this point it is important to understand a basic principle of physics which states that an object in motion will remain in motion at a constant direction and speed unless acted upon by another force. Don't forget that either.

When you lean the bike to the right, the shape and rotation of the side of the tire brings into play another force acting on your bike, which causes it to turn to the right. The geometry of your tires rotating downward in relation to the surface of the road brings friction force into play. This friction force comes into play PUSHING your bike to the right.

Suddenly, you have two different forces acting on you and your bike other than kinetic energy. You have gravity pulling you down, the vertical vector, and centripetal force pulling you to the left (while you are turning right), the horizontal vector. Any time you have two forces acting on an object, in this case your body, the combination of those two forces creates a third vector, the diagonal vector.

The length and direction of this vector is determined by the relative lengths and directions of the other two vectors. Since gravity remains constant on flat ground, then the variable is the centripetal force but it will only vary in intensity. As the centripetal force increases in intensity, it causes the diagonal vector to increase in length and become more horizontal. As the centripetal force decreases, the diagonal vector shortens and becomes more vertical or in line with gravity until it equals gravity when you are riding in a straight line.

If you find this confusing, read it again and again until you understand it. It is important that you understand this so you can figure out when someone is telling you something wrong about cornering.

The diagonal vector represents the combination of the other two forces which, to make it easier to remember, We call it your racing gravity. We call the direction that this vector is pointing your racing down, or the direction in which your racing gravity is pulling you.

At this point, common sense should tell you that you must keep the center line of your bike in line with your racing gravity and you must keep your center of gravity or weight placement so that the center line of your bike is directly between your center of gravity and your racing down. If you move your center of gravity to either side of the centerline of your bike, your bike will move in that direction.

While cornering to the right, if you move your center of gravity to the left, either your bike will set up and you will stop cornering or you will flip off of your bike to your left. If you move your center of gravity to your right, either your bike will lean more causing the bike to turn harder or the bike will lean too far causing the tires to lose traction, you will go horizontal with your bike, and crash.

We regularly hear and read riders being told that they should put their weight in their outside pedal when

cornering. By this point you should understand that if you put your weight in your outside pedal when cornering, it will cause your bike to set up and you will either stop cornering or crash.

Then why are you being told to put your weight in your outside pedal when cornering?

It is very simple. These people, when cornering, feel pressure on the bottom of the outside foot when cornering and mistakenly take this to be their weight being shifted to that foot. Actually, they are keeping their weight over the center line of the bike and putting pressure in their outside pedal.

There are two proofs that you are not putting your weight in your outside pedal when cornering:

(1) Lean your bike in a standing position against something while standing next to it. Put your foot on the outside pedal with the pedal at the bottom and push down hard with your weight but not too hard (you don't want to hurt yourself.) Your bike will quickly slap upright against your leg.

(2) If you are pedaling through a corner, how can you be putting your weight in your outside pedal? It should be common sense that you cannot pedal with all your weight in one of your pedals.

If you think about what is happening while cornering in relation to physics, you will find that you are instinctively doing something interesting. You are keeping your weight over the centerline of the bike in relation to your racing down and racing gravity to hold it in the proper position for cornering AND you are torqueing the bike tires into the ground to increase your traction to keep it from sliding out.

Pay close attention to BOTH your hands and feet.

You will find that you are pulling up on the inside handle bar and pushing down on the outside handle bar to force your front tire hard into the ground. The pressure on your outside pedal is meant to help force the rear tire into the ground.

Therefore, the proper cornering technique is to sit on your saddle, relax, torque the bike just a little to cause the tires to bite, and let the bike arch through the corner. Your upper body and head should drop lower and toward the inside so that your head will be just about over the inside brake lever. This is to better position your center of gravity on the bike in relation to the centerline of the bike. It is also important to keep a smooth arching line through the corner. Bobbing and weaving will throw your line off. It is just that simple.

Oh, did we say relax? Yes, because tensing up will cause you to pull the bike to the outside, losing control, and forcing yourself to brake to regain control.

Remember what we told you about the word relax being one of the most important words in cycling? That is very true in cornering. If you tense up while cornering, you tend to push your center of gravity away from the corner or toward your outside. This causes you to pull hard to the outside and can easily cause you to crash. Therefore, it is crucial that you practice cornering until you learn to instinctively relax while cornering.

Relaxing is the single most important thing most people can do to improve their cornering.

Let us teach you a technique for helping you relax for corners. You will find that when you tense up, you grip the handlebars very hard. This causes your forearms to tense up because the muscles, which control your fingers, are in your forearms.

In order for your forearms to tense up, you have to brace them by tensing your upper arms and to tense your upper arms you have to brace them by tensing your shoulders. Just grab anything really tight with your hand and feel the muscles up your arm to your shoulder with the other hand. You will see that all the muscles are tense.

This tensing action causes you to straighten your arms and push away from the corner which causes your bike to pull toward the outside causing you to lose control. Therefore, to relax for corners, you simply relax your grip around your handlebars, which permits all the other muscles to relax.

Before you commit to the corner, let your fingers hang until the muscles up your arms relax and then gently wrap your fingers back around the bars just tight enough to have a firm hold on the bars. You will find that this little trick will make it possible for your entire body to relax which will improve your cornering.

Clearing the Corner

As you are approaching a corner, there are several things you need to do. First, you need to do what we call clearing the corner. What you are doing is looking as far into the corner and at the road surface to see if there is anything that can cause you to crash. You are looking for irregularities in the road surface, sand, water, rocks, and other objects like the bodies of racers who have crashed ahead of you. You should clear the corner before you lean into the corner.

After you have cleared the corner and just before you lean into or commit yourself to the corner, you look as far through the corner as you can. You will find that you and your bike will follow your eyes through the corner. If you are looking at the road in the corner, you will tend to pull to the outside and lose control of the bike because it is too close to you to set the right line through the corner. If you can't see all the way through the corner, look as far as you can as if you can see all the way through it.

Remember that you will use your center vision for what you want to be your main focus and use your peripheral vision to watch other things. When cornering, use your lower peripheral vision to monitor the ground searching for something you may have missed such as rocks, water, and sand while keeping your main focus through the corner.

This is particularly important when riding a blind corner you can't see all the way through. You keep your focus through the corner while constantly clearing the road with your lower peripheral vision as the road comes into view. This way, you don't lose your line in a blind corner.

Oops!!!

You are committed to a corner, part of the way into it, you suddenly find yourself in trouble. What do you do?

First, it is important to understand what happens if you don't react right. Your bike will lose traction with the ground, you will suddenly lose all that nice friction force which is pushing you through the corner, you and your bike will suddenly go horizontal, and you will immediately move in a straight line towards the outside of the corner at high speed.

This will happen so quickly that the riders on your outside will not have time to react much less get out of your way. You will cut under them, taking their bikes out from under them, and crashing them. This all happens in a split second.

The proper reaction is to set the bike up in a straight line, slam on your brakes, and bring the bike to a stand still or back under control. This sounds drastic but is the best thing to do when you have just had something happen which is causing you to crash because it keeps the bike under you and the people on your outside will keep their bikes under them, it also permits all of you enough time to straight line your bikes and grab your breaks, and it keeps you reasonably under control. Watch the pros. They often use this technique with not one person hitting the ground even with a rolled tire.

How do you do this? Just as soon as you feel the bike start to go, you kick your hips to your outside in one quick move. This stops the cornering by straightening the bike up and brings you back on top of your bike with your wheels down.

By the time your bike has straightened up, you have had more time to react to braking than it would have taken for you to knock down the first rider to your outside. This has permitted the rider on your outside to have enough time to react, straighten his bike up, and hit his brakes. You just saved two or more riders a lot of skin.

It is very important that you not use this technique as an out for panic. If you are not comfortable in a peloton while cornering, you didn't do your cornering drills and should go to the back of the peloton to practice following the pack through the turns until you feel comfortable leaning through the corners.

Now, let's say you are on a fast down hill in a blind curve. Suddenly, you see sand in the corner. DON'T PANIC!!! First, lightly hit your brakes just enough to feel your weight shift forward a little bit. This will decrease your speed enough that you can take a sharper line through the curve, which you will need after your next move.

Second, just before your front wheel hits the sand, release your brakes and set your bike up in a straight line until after your rear wheel has cleared the sand and had enough time make one revolution after passing through the sand, then lean back into the curve on a slightly tighter line to continue the curve at the now slower speed. If necessary, resume braking by caressing your rims.

If you remain leaned in the sand, your tires will lose traction when they get on the sand, they will slide out, and

you will crash. If you don't release your brakes before hitting the sand, your wheels will lock up when you get on the sand, you will lose traction, and crash. Understand? Good. If not, read it through again and think about it.

The main thing is to keep control and keep the wheels down. This requires remaining relaxed as much as possible and the only way you can do that is to practice your cornering drills.

Inside? Outside?

Over the years, we have often heard discussions between racers who were concerned more about crashing than winning. They would tell less experienced racers that you ALWAYS want to be on the inside when taking a corner because, if someone crashes on your inside, they will carry out into you causing you to crash.

If not crashing is your primary concern in a bike race, then they are partly right. What if you are cornering slowly enough that a rider doesn't carry outside when he crashes? This is especially true with 180º turns. When you crash when going too slow, you just drop and stick because you are going too slow to have enough centripetal force to carry you outside.

In slow corners, it is safest to be on the outside so you have an out in the event the rider in front of your crashes. If you are going really fast in a corner and the rider in front of you crashes, you tuck inside of him just a little because he will carry out from in front of you.

But, in a slow corner, the rider will just drop where he is, therefore, you must set the bike up and go to his outside because you will have riders or a curb to your inside. We always taught riders in the lower categories to take really sharp and slow corners on the outside so they could set up and get around crashes. We got thanked more than once after a race.

Proper Racing Line

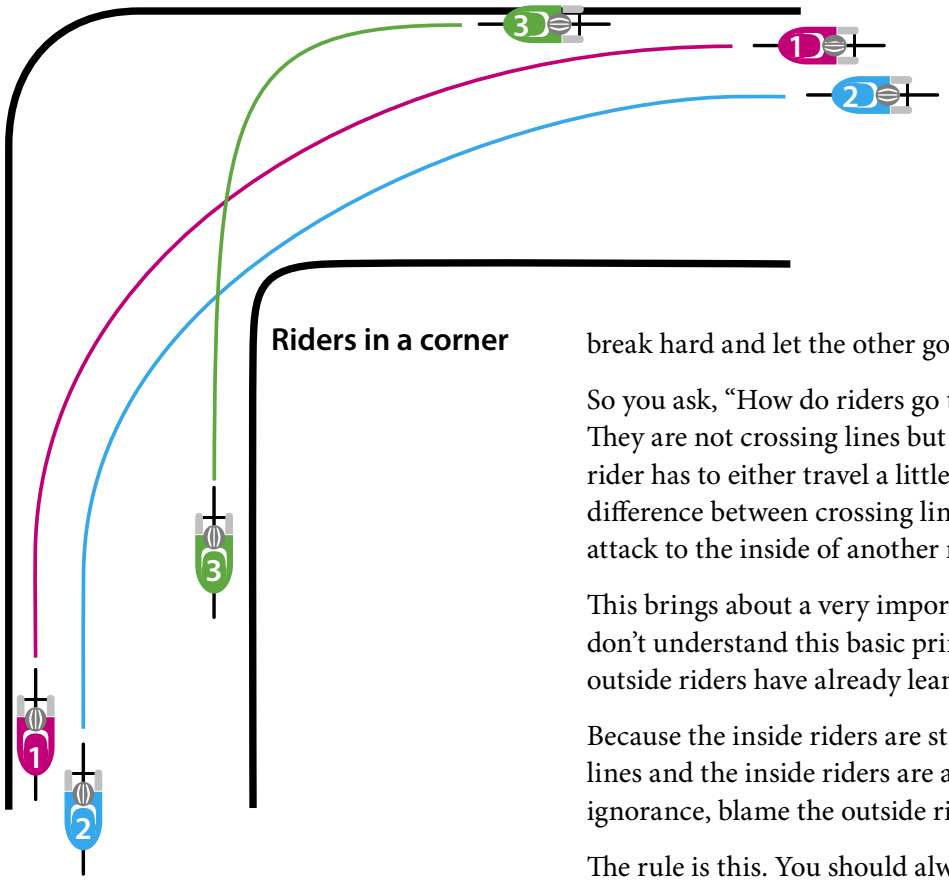
Back to the graphic (repeated on next page). We are going to talk about the red, blue, and green riders so review the picture again paying close attention to their lines through the curve.

Basic physics teaches you that the proper line through the corner above should be from the outside to the inside back out to the outside like the blue and red riders are doing. The reason for this is because it "flattens out" your line through the curve. The flatter your line through the curve, the faster you can take the curve.

Look at the line for the green (right) rider in comparison to the line of the other two riders. He is setting up on the inside and going straight to the outside. His line is much sharper which means he won?t be able to take the corner as fast as the two other riders.

This is true for almost all corners even for down hill curves. You should always go from outside to inside to outside in order to flatten out and open up the curve.

The exception to this is the complex corner where you have to set up for one curve to come out of the first curve in



Riders in a corner

proper position for a second curve immediately following the first curve. This takes practice because you have to be able to see the line for the second curve, the required entry point for the second curve, and then trace that back to where you have to exit the first curve. This permits you to establish where you should enter the first curve. It helps if you practice riding figure 8's.

Crossing Lines

Look at the green (3) and blue (2) riders in our picture. They are crossing lines in the curve. If they go into the curve at the same time, either one will have to break hard and let the other go or they will both crash. Riders should never take different lines into a corner.

So you ask, "How do riders go through a corner two or more at one time?" Look at the red (1) and blue (2) riders. They are not crossing lines but are taking PARALLEL lines through the corner. This means that the outside rider has to either travel a little faster than the inside rider or he will lose ground. As you can see, there is a huge difference between crossing lines and taking parallel lines in a corner. The parallel line is how the pros will even attack to the inside of another rider in a corner.

This brings about a very important matter we have seen with increasing occurrence in bike racing. Riders who don't understand this basic principle of physics try to keep passing on the inside just before a curve after the outside riders have already leaned or committed to the corner.

Because the inside riders are still going straight when the outside riders have committed, they are taking crossing lines and the inside riders are almost always "cut off" in the corner and forced to hit their brakes. They, in their ignorance, blame the outside riders but the truth is that the inside riders were in the wrong.

The rule is this. You should always be merged with and running a parallel line with the other riders in a pack at least 10 meters before the outside riders commit to the corner. If you are not, you will cross lines in the corner and either get cut off forcing you to brake hard and lose ground or you will crash. You cannot violate this rule because it is basic physics and you cannot change the laws of physics just because you want to move up one more position before the corner.

Therefore, it should be common sense that, if the pack is not going all the way out for either the entry or exit or all of the way in at the center and they are not braking for the corner, then the corner is wide enough for them to take the corner at full speed without using the full width of the course.

This means that, as long as you ride a parallel line, you can pass the pack on the side where they are not going all of the way to the curb. Understanding these basic principles makes it possible for you to develop tactics based on the way the peloton takes a given corner as long as you obey the rules.

If you find that a pack tends to over brake for a corner and is not going all the way out to the curb on the exit, you

can save energy by drifting outside one bike width going into the corner, not braking and letting your speed carry by passing people on the left, and not having to accelerate every time out of the corner.

This is a risky move and you must use your own discretion as to whether or not to make this move because a rider could drift out at the exit and put you into the curb. To help prevent this, it is best to estimate your passing so you will be along side of the rider you exit the curve with so he will know you are there before he exits the curve and will leave room for you.

Of course, the opposite is true. Let's say the pack is going into the corner at full speed and not having to go all the way to the inside curve. If you take a parallel line through the curve, you can attack under the other riders into and through the curve to get a jump on them before they exit. This is commonly used by pros for attacking and going into the final sprint.

Cover the Rider on Your Inside

Eddy Van Guyse (the race announcer) gives this piece of advice on how to corner in a pack of 100+ riders when you are going through a curve side-by-side.

Eddy says, "Always cover down on the rider to your inside." By this, he is telling us to always leave room for the rider on my inside to navigate the corner because, if we don't and she/he crashes, she/he will carry outside into you and we will both crash. It is a pretty good rule. Don't forget it.

The way this works is quite simple. You are both carrying kinetic energy into a corner and using friction force to push you through the corner on just the right line. This means that the two forces have to be balanced just right or your line will change, possibly causing you to suddenly lose control and crash.

When any two objects, which are in motion, collide, they exchange energy causing them to change directions. If you don't leave room for the rider on your inside in a corner, you will cross corners, collide, exchange energy, change lines very radically, and possibly crash.

Rider Size & Cornering

We may of have heard a myth about rider size and cornering which needs to be put away. We KNOW that smaller riders corner faster than larger riders. The myth has it that this is because the larger rider has a higher center of gravity and is, therefore, less stable in the corner.

This is true for a four-wheeled vehicle because it cannot lean to keep its centerline in line with the vehicle's center of gravity. But it is not true with a two-wheeled vehicle because the vehicle can lean.

You see, as long as the center of gravity is in line with the line of the vehicle and its racing down, the vehicle is stable regardless of how high the center of gravity is. Therefore, the center of gravity cannot be the reason that smaller riders corner faster.

The reason smaller riders corner faster is because smaller riders ride smaller bikes, which have a shorter wheelbase from front to back. On a racing car, there are two things to wheelbase, which affect the cornering speed of the vehicle. These are the front-to-back wheelbase (FB) and the side-to-side wheelbase (SS) of the vehicle. We are not concerned with the SS wheelbase because we only have two wheels and lean in the corner.

What you need to know is that the shorter the FB wheelbase is, the faster you can corner. This is because a shorter FB wheelbase permits the vehicle to take a sharper line through a corner at a given speed or a faster speed for a given line through the corner.

A really great example here is a large truck turning in relation to a small car with the same SS wheelbase. The large truck has the longer FB wheelbase and has to take a longer line through the corner and/or a slower speed through the corner. This is true with a bicycle.

This is very important if you are a criterium specialist and want a custom designed bicycle to help you be faster in corners.

What you want is a bike with steeper seat tube and head tube angles. The steeper seat tube angel moves the seat tube farther forward making more room to move the rear wheel forward. The shaper head tube angle moves the front wheel backwards.

These two things in combination decrease the FB wheelbase and make the bike faster in the corners. As a matter of fact, you will notice that track bikes have sharper tube angles and a shorter FB wheelbase, which makes them faster and easier to handle in the turns.

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