

Effortless Speed, Agility, and Quickness
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Let's take a close look at what it really takes to improve your reaction time, speed, agility, and quickness. Without understanding this concept of training, all the speed and agility drills in the world won't make you any quicker!

Applying Newton's Third Law of "Action-Reaction" to Make Your Athletes Faster
Maybe it's time to dust off the old science books and take a hard look at the science behind speed, quickness and agility- Nah! All you really need to do is look at Sir Isaac Newton's Third Law of Action-Reaction. Simply stated, it says for every action there is an equal and opposite reaction. How does this apply to speed, quickness, and agility? When an athlete makes a cut or comes out of the blocks, there is a quick force applied in the opposite direction of travel. The force created into the ground or blocks, in this example, will be met with an equal force coming back at the foot. As long as the object the foot is applying force to is stable and is not giving way to the foot, action and reaction forces should be equal.

Now, how can this be applied to speed, quickness, and agility or overall athletic movement in any direction? There are a few techniques that must take place for the athlete to take advantage of Newton's Law of Action-Reaction. The first technique is to use the reaction force from the ground as quickly as possible by not absorbing with a big flexion of the knees and hips. For example, if a basketball player is playing defense in a shuffling action to stay with the ball handler and the ball handler quickly changes direction, the defensive player must react and quickly apply force into the ground in the opposite direction of travel to move with the ball handler. If the defensive player allows his hips to drop significantly or shoulders to sway side to side or forward, this will have a definite impact on how quickly the change of direction is made. The reaction force out of the ground will have been dissipated because of too much absorption by the hips and/or swaying of the shoulders. The athletes must learn to apply force with stable joints to take advantage of the reaction from the ground. This may help you to see the importance of low level, quick response, multi-directional plyometrics in improving agility and quickness.

The second technique is to apply force into the ground at an angle that allows the body to be pushed in the direction of travel most efficiently, known as the angle of force application. In performing a lateral shuffle, the angle of the power leg (the leg pushing the body in the direction of travel) must be positioned such that it doesn't create an "up lift" of the body by positioning the feet too far under the hips, or a slipping effect by positioning the feet on too wide an angle outside the hips. The angle of application is even more critical when talking about stopping and changing direction. The angle of the leg stopping the body must be correct in order to be efficient and handle forces.

The final technique I like to teach to my athletes in regards to action-reaction is the influence of the arm action. It is more commonly seen with sprinting or accelerating in a

straight line, but is equally as important when moving laterally. When the arms are used properly in linear acceleration, there is a coordinated action between the knee drive and arm action. The more active the arms are, the greater the knee drive can be. Obviously, poor flexibility, crossing the arms in front of the body, and other biomechanical faults will hinder speed. If the arms move in too short of a distance in the forward and backward swing, this will limit how high the knees will drive. This has a definite influence on stride length and speed. More importantly, the lack of a high knee drive, due to a lack of arm drive, will directly influence the action of the push off leg into the ground and, therefore, the reaction out of the ground. You see, it is the opposite action of the drive knee that directly influences the power of the push off leg into the ground. And it all starts with a well coordinated arm action.

I don't know how fast Sir Isaac Newton was, but he definitely had a huge impact on speed. It is important to teach your athletes to apply the greatest amount of force into the ground as quickly as possible. This will surely lead to faster and quicker athletes. Listed below are two simple drills to teach the law of action-reaction and maybe help your athletes get a better grade on their next science exam.

- **555 Shuffle Drills:** Set up two cones that are 5 yards apart. Have the athletes shuffle from the start to the far cone, back to the start, and finish at the far cone. What you are looking for is acceleration with the power leg, the hips staying level, and a quick stop and change of direction with little hesitation. Watch where the plant foot is positioned. It will tell you a lot about how to correct quickness.
- **Forward and Backward Sprint:** Set up two cones that are 8 yards apart. Have the athletes start at the first cone and accelerate as quickly as possible to the far cone. Upon reaching the far cone, the athlete should slow stop under control and back pedal under control back to the start. When reaching the starting cone, the athlete will immediately stop and change directions and accelerate to the far cone. Repeat for ten seconds. You are watching the transition from back pedal to forward more closely on this drill. The angle at which the back foot is applied should be great enough to stop and start with no hesitation or slipping. The shoulder must fall forward in line with the legs and hips to create a straight line. If the athlete positions his plant leg poorly or positions his shoulders poorly, it will be recognized immediately due to a sluggish take off.

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