

Single-sided Pips-out Penholder Play - 2. Basic Physics

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2. Basic physics.

2.1. Trajectory and spin. Friction and pips. Distance to the table.

A ball moving forward will follow a trajectory which curves downward, for although its speed will keep it moving forward in a straight line, gravity will pull it down. It will lose speed due to air resistance. The less forward speed, the faster it will drop.

Air will flow over and under a ball which is moving forward. A rotating ball drags air with it; if its backside rotates upward (topspin) the ball will drag air in that direction; it will drag the air away from under it and push it into the air that is flowing over it. As a result there will be denser air above it than under it and the pressure of the air will force the ball down. This is how topspin makes a ball land sooner on the other half of the table. Faster rotation means more air pressure, so an even sooner landing. Faster rotation also means a more stable trajectory, since a rotating object will tend to keep its axis of rotation at the same angle.

If a ball is rotating the other way (backspin), it will drag the air flowing over it downward at its backside and push it into the air flowing under it, thus forming a cushion of denser air below it. As a result the ball will float, pushed upward by the denser air. This is how backspin will make a ball drift over the table if it is hit too hard. Faster backspin means more air pressure under the ball, so more drifting. And again faster rotation means a more stable trajectory.

Rotation is imparted by friction. Friction depends on surface contact. With a short pips-out rubber the ball will make contact with the pips. The surface of the pips, taken together, is much less than the surface of a smooth (inverted) rubber. The amount of rotation that can be imparted even by a grippy pips-out rubber is, therefore, also much less than the amount that can be imparted by an inverted rubber. Normally a pips-out rubber can not impart enough rotation to make a ball land significantly faster than a non-rotating ball. This means that, when playing with pips, the normal trajectory of the ball will be practically a straight line, only curved slightly by the influence of gravity.

If a ball drops down on the table it will bounce. It will make friction with the table. If it is rotating with topspin it will make friction pushing itself forward; once aloft again, it will still have topspin and therefore it will follow a fast sinking trajectory. All in all, this ball will bounce lower than a non-rotating ball.

If it is rotating with backspin it will make friction with the table pushing itself backward; it will bounce up still having backspin and therefore be slow in falling down again. All in all, this ball will bounce higher than a non-rotating ball. It is convenient to measure the height of the bounce using to the height of the net as a standard. This is why. If you want to hit a ball from your baseline directly (that is, in a straight line – the fastest way) onto the other half of the table, the ball must be at least twice as high as the net is. Even then it will land only just on the table. It would follow a straight line from your bat over the edge of the net to the baseline of the other half of the table, but gravity will pull it down, no matter how hard you hit it, so it will actually land a few centimetres before the baseline. It would land significantly closer to the net if a significant amount of topspin would be imparted on it; however, with short pips you will not be able to achieve this. Therefore, to a pips-out player any ball bouncing twice as high as the net or lower is a low ball which has to be lifted over the net; any other ball is a high one and can be hit directly over the net onto the other half of the table. As a ball which has to be lifted cannot be hit hard (it would go over the table), this limits the distance a pips-out player can be from the table: he must never be further away from it than the point where he can hit the incoming ball before it starts to drop after its bounce on the table.

2.2. Mechanics of short pips. Angle of the blade. Forward and upward motion.

In order to impart spin with pips one has to make the surface of contact as great as possible; this is achieved by having the ball make contact both with the surface of the pips and with their sides. If the rubber is moved along a tangent of the ball's surface, that is, if it grazes the ball, the pips will bend (more or less, depending on their length and flexibility) and their sides will make contact with the ball. With pips, the ideal angle of the blade is, therefore, the face of the blade being at rectangles with the trajectory of the ball leaving the bat.

From this it follows that, at the point of contact, the so-called “sweet spot” of the blade must face directly the point where the ball is intended to land. It also means that, when hitting with pips, keeping your bat at the correct angle and aiming accurately with it come down to the same thing.

The faster the rubber is moved along the ball's surface, the more rotation will be imparted. As mentioned above, more rotation will make the trajectory of the ball more stable (this is also true of sidespin), so even when hitting high balls with pips, imparting as much spin as you can is generally needed.

However, spin cannot be used to lift incoming low balls; a pips-out rubber is incapable of producing enough friction to move the ball upwards by friction alone. In other words, if you close your bat the ball will drop off it – unless it is already rotating fast towards you; for an incoming ball with a lot of topspin will produce enough friction when making

contact with your pips to bounce off slightly upwards when you hold your blade exactly vertical. But the amount of incoming topspin is hard to judge. Also, you do not want to be dependent on the spin produced by your opponent, since he may decide to hit with less spin. The only sure way to lift a low ball, then, is by making use of the inevitable upward motion it has when it bounces off the table.

The ball goes up fastest when it comes off the table; when it has reached the highest point of its bounce its upward motion is nil. A ball with backspin will bounce fairly high, but on account of the direction of its rotation it will also want to drop off your bat; therefore it must be contacted as early as possible, when its upward motion cancels its tendency to drop off. A ball with topspin can be contacted later (even on the top of the bounce) because it will tend to bounce off your bat slightly upwards.

In order to make the best use of the upward motion of the ball, the face of the bat must be held as vertical as possible. Having the sweet spot of the bat face directly the point on the table where you want to land the ball will again make certain that your bat is in the correct position.

The trajectory of the bat is, geometrically speaking, always in the plane of its face; that is, the blade must move at the same angle its face makes with the table; or to put it in another way, the blade must move at rectangles with the desired trajectory of the ball. It will therefore seem mostly like a grazing wave and you may be fooled into thinking that little forward speed can be generated this way. But the bat contacts the ball always at its centre; by this solid contact the forward component of the motion of the bat, even if it seems small compared to the upward component, is completely transferred to the ball, whereas the upward component, by grazing the surface, is transferred to it only for a small part. In fact, the ball will leave the bat always at rectangles with its face, that is, directed completely forward. Therefore, by making solid contact you can hit the ball with great forward speed even when your stroke is mostly going upward. It is very necessary to keep this in mind, for almost every player when under strain is inclined to make his bat go forward too much; as a result, the ball will go into the net (because it is not lifted) or over the table (because it is hit at the wrong angle).

2.3. Mechanics of muscle. Mechanics of mind.

Direction and speed are only transferred to the ball at the moment of contact. The part of the motion of the arm (or rather of the whole body) before this moment, the "upswing", and the part of the motion after it, the "follow-through", do not contribute anything whatsoever to the direction and the speed of the ball. Therefore, they should be as short as possible, in order to avoid loss of energy and loss of time. However, they do have their own function.

The upswing is the part of the motion of the arm in which the angle of the blade and the direction of the motion is established. It is also the part of the motion in which the speed is generated. In order to control angle, direction and speed well it is necessary to start this part of the motion slowly and accelerate towards the ball. Otherwise, the motion will be hasty and less controlled. At the start of the motion body and arm should be loose and relaxed; force should come rushing in just before contact is made with the ball. At the point of contact the motion should always be well controlled, yet very fierce, even with delicately played balls. This is called the "one inch punch", a term employed by the great and unique three times (1961, 1963, 1965) consecutive world champion Zhuang Zhedong, which in Kung Fu indicates a sudden burst of power generated by a small motion. Only in this way, all of the intended speed and direction is actually transferred to the ball.

The follow-through is the part of the motion in which the muscles of the arm and the rest of the body are relaxed. You should let go of the fierceness immediately after the point of contact. Otherwise you would spend valuable energy in vain. Relaxing is also needed to feed new energy to your muscles; they cannot take up new energy as long as they are contracted. Finally relaxing is necessary to be able to bring your arm back in a position from which you are ready for the next move.

There is, therefore, a rhythm to the motion of your muscles: build up force, make contact, let go. With every stroke you should go through all of these three stages. Do not underestimate the importance of relaxation. If you do not relax time and again in this rhythm, adrenaline will build up in your system and your muscles will start to contract randomly, impairing your accuracy, and finally they will cramp.

There is also a mental rhythm. You must be concentrated from just before the serve to the moment when the point is made; immediately after that moment you should relax. As is the case with your muscles, your mind needs energy and it is taking up new energy best when (relatively) resting. Also as is the case with your muscles, your mind will cramp when it cannot relax timely. So when the point is won (or lost), immediately turn away from the table and relax. Relaxing your body will help to relax your mind. The most effective way to bring about relaxation of your body is to relax your shoulder muscles; let your shoulders sag. It also helps if you relax the muscles of your abdomen; let your belly sag too, breath with it (that is, keep it loose and have it expand when you inhale). The most effective way to bring about relaxation of your mind is by relaxing the many muscles of your face; keep your mouth closed, but let your jaw sag, keep loose your lips, relax your eyes by unfocusing, and relax the muscles of your forehead and ears. In short, have your face lose all expression. You may have noticed that many Chinese and Korean players have expressionless faces between points; this is the reason why.

After relaxing you have to focus again. Many players use a word or a short phrase said aloud to do this. Lee Eun Hee uses a little cry, sounding like "Pep", which is her own pep-talk, I guess. Ma Lin shouts something resembling the French "Allez!" Others, like Gao Jun, remain completely silent in order to gather their inner strength. Whatever you do, take the time for it.

Never give in to anger, never become even irritable. If angry, you can be provoked; if you can be provoked, you will be predictable; if you are predictable, you will lose the match. If irritable, you can be made to lose focus; if you lose focus, again you will lose the match. Be a master of your emotions.