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Mechanics of TT

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1. INTRODUCTION

Nothing that happens on a TT table is inexplicable as long as you are aware of the basic laws of physics. Once the ball has left the racket, the trajectory and direction is determined by the power and spin fed into the stroke. The trajectory itself is determined by gravity, the air resistance and the influence of the spin. A similar stroke will always produce a similar result in terms of spin, speed and direction. One can of course point out that things will not be exactly the same depending on where one finds oneself on the earth's surface. The weight of the ball can vary by as much as 0.5% depending on whether you play in a position near the poles or in a locality on the equator. However this is really quite meaningless when you consider that the rules allow a variation of up to 5% in the weight and diameter of the ball and at the most 8% when we are talking about bounce.

Far more significant variations occur in air pressure when we talk about height above sea level for example. At 1000 m air pressure sinks by 12% and at 3000 m by up to 30%! This has a major impact on both the air resistance and the effect of the spin on the ball in flight. A major championship event played for example in Mexico City will result in the ball 'flying' in an unusual manner and the players must be ready for this, as the trajectory of the ball will not conform to expected criteria. When players talk about a 'hall' being slow or fast this is a subjective experience. This can depend on different floor coverings, lighting, acoustics, heat and cold or just the size of the room. It doesn't mean that the ball is moving in an unusual manner.

Questions relating to materials and the differing spins and effects can be rather more complicated as the manufacturing companies have not tried to create standardised tests to measure exactly what their products can do. Often experienced players or testers (or in some cases not so experienced) categorise rubbers in terms of spin, speed and control, but obviously these classifications are purely subjective. Different players will for example use rubbers in differing ways and one player will often be capable of getting far more out of a particular rubber than another player would. Such 'subjective' testing can give some useful information but helps little in giving any base for objective measurement when comparing products from different manufacturers. Also materials and indeed techniques and tactics are constantly in change - it is necessary that we always have an open mind and are ready to look at new ideas and ways of doing things.

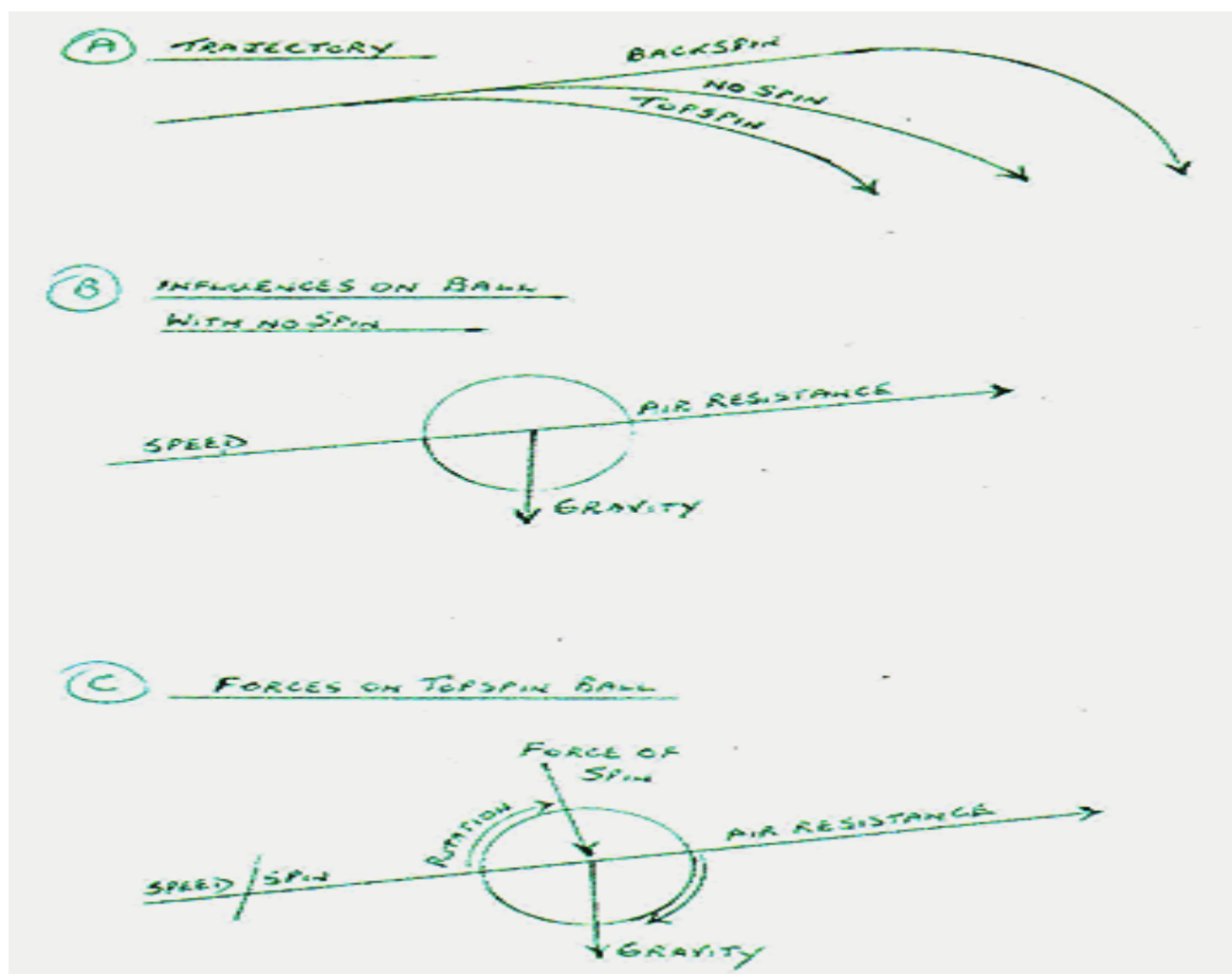
2. TRAJECTORY OF THE BALL

After leaving the racket regardless of the spin, speed or direction, the ball is influenced simply by 3 factors - gravity, air resistance and spin (Magnus effect) (Diagrams A and B). In the case of topspin, gravity and the

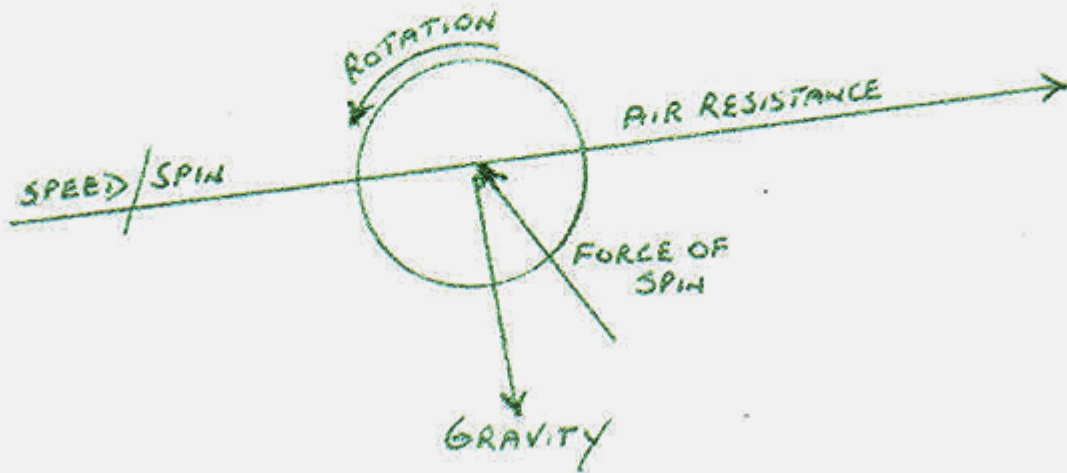
influence of the spin work together giving a more arced trajectory (Diagram C). With backspin gravity and the spin factors work against each other so that the ball will rise initially in a curve before dropping sharply when gravity predominates over the lessening spin (Diagram D). Gravity is always equally strong and always directed downwards. Air resistance is always against the direction of travel and its effect is strongly influenced by the speed of the ball.

With a speed of 8.5 m/s (30.6 km/h) the air resistance is about equally as strong as gravity. Air resistance however increases or decreases by the square of the speed. This means that a doubling of the speed to 17 m/s (61.2 km/h) signifies a fourfold increase in air resistance. Halving the speed to 4.25 m/s (15.3 km/h) would bring about a reduction in air resistance to around one quarter of gravity. In the case of fast counter play an average normal speed would be in the region of 12.5 m/s (45.0 km/h) which means immediately that it's always the air resistance which is the dominating factor in the early stages of the ball's trajectory. In the case of world records for counter-hitting (of so many shots per minute) an average speed of only around 33 km/h is achieved.

In the case of a top-spinning ball the force of the spin is at right angles to the speed and the rotational axis and as a result strengthens the downward pull of gravity. Very strong topspin is of the same magnitude as gravity and the ball will sink much more quickly. Note that a pure sidespin ball will have a distinct arc when seen from above. In the case of strong backspin the trajectory will veer upwards - here the power of the spin is stronger than gravity.



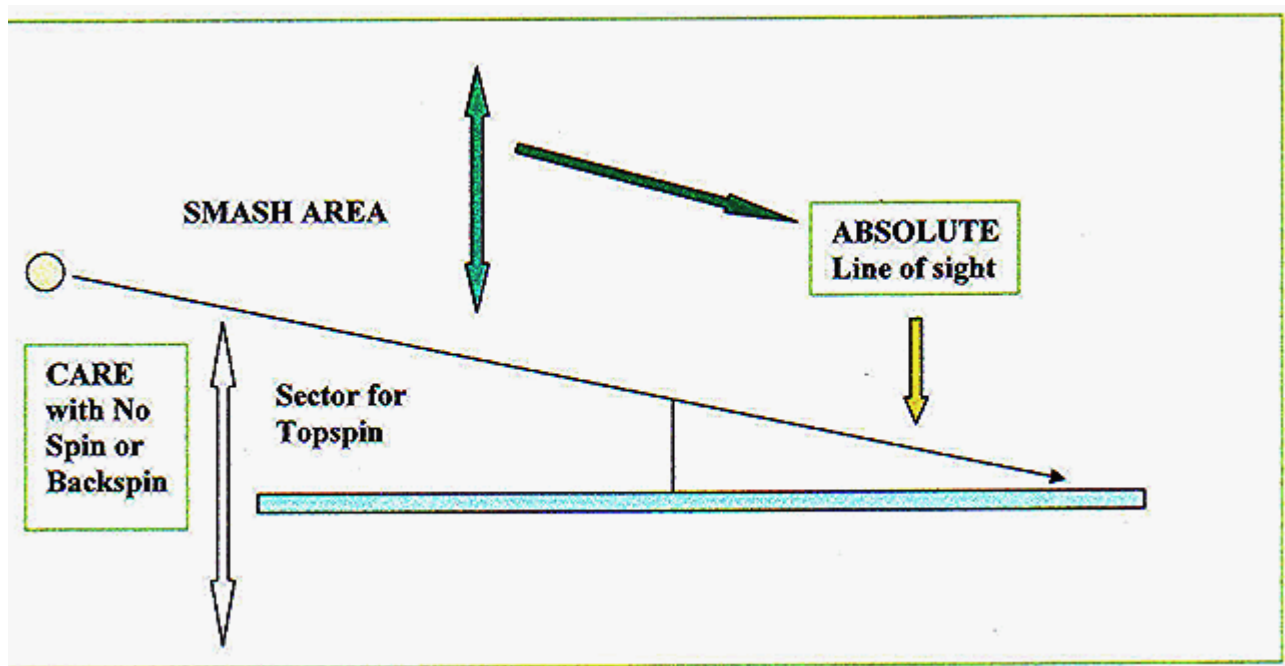
D FORCES ON BACKSPIN BALL



3. ABSOLUTE LINE OF SIGHT

Of course it is the player's own skill and technical knowledge which will determine his or her choice of direction, speed and/or spin. There is however an absolute limit for the all out hard smash where in theory one can utilise a completely straight trajectory.

Below the absolute line of sight the speed element in all no spin or backspin balls will be limited as all such balls will require an arc and some margin for error will be needed in the stroke. The no spin smash is the game's hardest hit (around 31.1 m/s (measured speed off the racket) or 112 km/h) and gives the opponent the least possible time to make the return. If balls higher than the absolute line of sight are looped instead, this means a slightly safer shot but at a slower tempo. However the difficulty in switching from topspin to smash often means that many players prefer to spin even in this 'high ball' situation.



Under the absolute line of sight topspin is used more than any other stroke as the arced trajectory allows more and more power to be fed into the shot while still retaining a high measure of safety with speed. The absolute line of sight is therefore a useful tool in judging the best stroke to play in any given situation.

OVER ABSOLUTE LINE OF SIGHT

- Smash

UNDER ABSOLUTE LINE OF SIGHT

- Topspin, backspin or counter-hitting with well judged (and controlled) speed.

Technique for the low ball

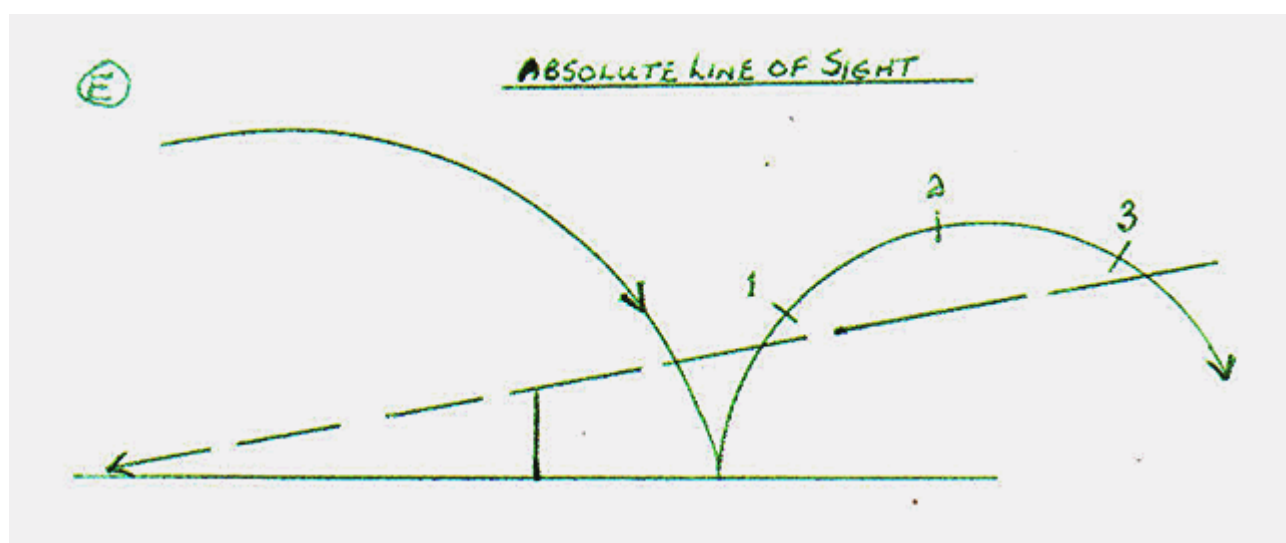
Often in the boy's game even from an early age it is a good idea to work with topspin as this gives high speed and also a high level of safety. With the help of topspin players can have a comfortable margin for error, a lower trajectory and a lower bounce on the opponent's side of the table.

Backspin with its straighter trajectory often tends to come through nearer to the end of the table. However in spite of this often the peak of the arc is higher and the ball can easily kick up after the bounce (there is also a reduction of speed at this stage) above the dangerous 'absolute line of sight', which leaves the defender open to a flat hit kill. It is therefore important that defenders take the ball as early as possible and above table height. Then they have the opportunity of a low ball over the net and a lower ball after the bounce, as the 'speed' element tends to take precedence over the effect of the spin and the ball skids through off the table surface. Also the earlier chop will retain more spin as it is in the air for a lesser time between strokes. Length is also crucial for defenders, either very long or very short, so that opponents have little opportunity to smash.

If defenders can introduce a topspin ball back from the table then this is a highly desirable variation, especially sometimes with sidespin. There will be a big difference between the topspin and backspin strokes and even the best of attackers will make mistakes.

4. SMASH AGAINST LOB

We should also look at the scenario where we face high lobbed balls. Here you will often have the opportunity of smashing from 3 areas, as the ball bounces upwards, at the 'peak' position or as it is descending (Diagram E). The 'peak' position (2) will need something like an overhead tennis smash and will bounce through high and long giving the opponent time to play the return, although the stroke is relatively safe. Killing the descending ball is also quite safe (3) but as you make contact from further back, you have less of the table to aim at and again the opponent has more time even though the trajectory will be flatter.



Theoretically the preferred contact should be as the ball bounces up (1). Here you have the chance to kill absolutely flat and angle the ball well as you are closer to the net - the opponent has very limited time to react. The problem can be that you have much less time yourself to study the spin and to react to any strange bounce. This contact is therefore a little more unsafe and requires practice (a short arm movement is important in this

stroke). An interesting alternative is to use topspin from an early timing position - even though this is a slower stroke which gives the opponent time it results in a more curved shot and a ball which drops quickly after the bounce. Other alternatives are the chop smash or a stop ball taken very early.

5. FLICKING THE SHORT BALL

The flick requires some feeling as the ball must be kept as low as possible over the net and yet it is difficult to create speed from a short ball often served with backspin. Good topspin can create a safer stroke but often it is not easy to achieve this over the table. To reach maximum speed over the table the flick should be taken at the 'peak' of bounce on every occasion, though the late-timed stroke played more slowly can also open up possibilities.

It is possible to feed in approximately 10 - 15% more speed into the diagonal flick because of the increased distance involved. (Total available distance 3.1 m as opposed to 2.7 m)

If you wish to flick more safely, with a higher margin then this will require playing the stroke more slowly. Flicking straight and low over the net will result in a maximum speed of around 8.0 m/s (28.8 km/h) but this would drop to 7.0 m/s (25.2 km/h) if you wished to have a 2 cm cushion over the net. Diagonal play would give the higher figure of about 10.0 m/s (36.0 km/h) dropping by 10% (32.4 km/h or 9.0 m/s) if the 'safer' diagonal stroke were attempted. The flick can often be angled harder and more easily than the counter hit as it is taken closer to the net and with less speed on the incoming ball. However no amount of training can increase the power of the flick beyond what the natural laws allow. The lifting movement (attacking a ball lower than net height) sets the limit and this can only be overcome by the creation of more topspin. However as we have intimated this is extremely difficult in the case of a low over-the-table ball.

6. COUNTER-HITTING

If you assume that two top players take the ball about 20 - 25 cm off the end of the table then in a rally the ball would reach average speeds of around 12 - 14 m/s (43.2 - 50.4 km/h, straight and diagonal respectively). In the case of the safe 2.0 cm over the net stroke, speeds would be around 11.0 - 12.5 m/s. When you compare this with the flick, the latter stroke would not achieve speeds in excess of two-thirds of counter play or around 10.0 m/s (36 km/h).

The dominance of the Asian players over the years has occurred primarily because they take the ball early, just after the bounce. European players on the other hand take the ball at 'peak' or after the top of the bounce. The difference in usable reaction time gives Asian players a real advantage by preventing opponents from coordinating and organizing their best strategies.

7. SERVICE, SPEED AND TIME

The serve can vary a great deal but the service rules and natural laws impose certain limitations. Because the serve must bounce from one half of the table to the other this means a minimum upwards and downwards movement of around 34 - 35 cm (17 + 17). The time frame is approximately 0.38 s for a backspin or float serve but this can be reduced in the case of strong topspin. One must bear in mind that the limit for a long serve straight is 2.7 m but this increases to 3.1 on the diagonal.

The time limit from bounce to bounce is around the same for a long and short service. However in the case of the short serve one must add the time from the racket contact to the first bounce which will add 0.15 - 0.2 sec. The total time for a short serve can be as long as 0.6 s compared with the 0.4 for a long fast serve. The speed for a long fast serve will be very similar to the speeds when flicking - between 8.5 m/s (30.6 km/h) straight, up to 10.0 m/s (36.0 km/h) on the diagonal.

8. SPEED AND SPIN

Strong spin presupposes that sufficient power has been used but spin and ball speed are connected and it therefore follows automatically that high speed will more often than not entail high spin.

The short serve will therefore always have a measurable spin which can be reckoned by the number of revolutions per second, while the long serve can have stronger rotation due to the increased power input. We don't always experience this on the table as we often play with care against the short serve, however even a small lack of touch can lead to a ball in the net or a high return. Aggressive returns such as flick and long push do not require so much touch and are less sensitive to the spin element on the ball, therefore it is safer to play long if you have learned the technique and if the opponent's playing style allows this. Also flicks against backspin can use the spin already on the ball and will result in a low dipping shot - long, fast service returns over 8.5 m/s will slow due to air resistance and this again helps when using topspin.

With the help of unusual or deceptive actions the server tries to hide the spin, speed or direction so as to gain an advantage over the opponent, lengthening his reaction time or making it harder for him to read the spin. Bear in mind that the variations to be found in the use of spin, speed, length and placement will often be sufficient to cause problems for opponents and it is important that your players can use the same serve in differing ways and execute differing serves with the same or similar actions.

9. RACKETS AND RACKET COVERINGS

After contact with a blade (without rubbers) the ball will retain on return about 85% of the incoming speed. In the case of a racket with 2.0 mm fast reverse rubber the return speed after the contact will only be about 70% of the incoming ball's pace. For an attacking player the rubber's task is to preserve the speed as much as possible (a part of the ball's energy will always be lost against the surface) and at the same time give the player a good chance to create and vary spin during play. It is obviously important that the outer surface of the rubber has high friction, while the sponge can vary in hardness depending on whether the player needs more spin or speed.

Harder blades and sponges give more speed at the expense of control while softer blades and sponges provide more spin and control as there is a longer contact time on the blade (without gluing you lose between 10 - 20% of the speed and spin). The blade also has its part to play and even under the rubber and sponge it can deform against a hard hit. One can easily see that with a contact speed of up to 31.1 m/s (112 km/h) and a contact time of a thousandth of a second, with a ball weighing 2.7 grams, the impact can be very considerable. If the stroke is not played absolutely cleanly then strong vibrations can be created in the blade with ensuing energy losses. An 'unclean' hit always gives slower speed.

Generally we can say that half the racket speed contributes to spin and the other half to speed. What you gain in the one aspect you lose in the other. When looping against a topspin ball the spin must be reversed which requires strong friction and a very closed racket. Looping against backspin means that you play with the spin which needs much less friction but a considerably more open racket angle.

10. FRICTION AND BOUNCE

Irrespective of the ball's movement in the air, the friction and bounce depend on the material qualities of the racket and of the table. Although in principle the same natural laws should apply during ball/table contact and in ball/racket contact, here the two surfaces are dramatically different, varying from smooth and shiny to sticky with immense friction. Another vitally important factor is that the bat is usually used actively while the table's part is always completely passive.

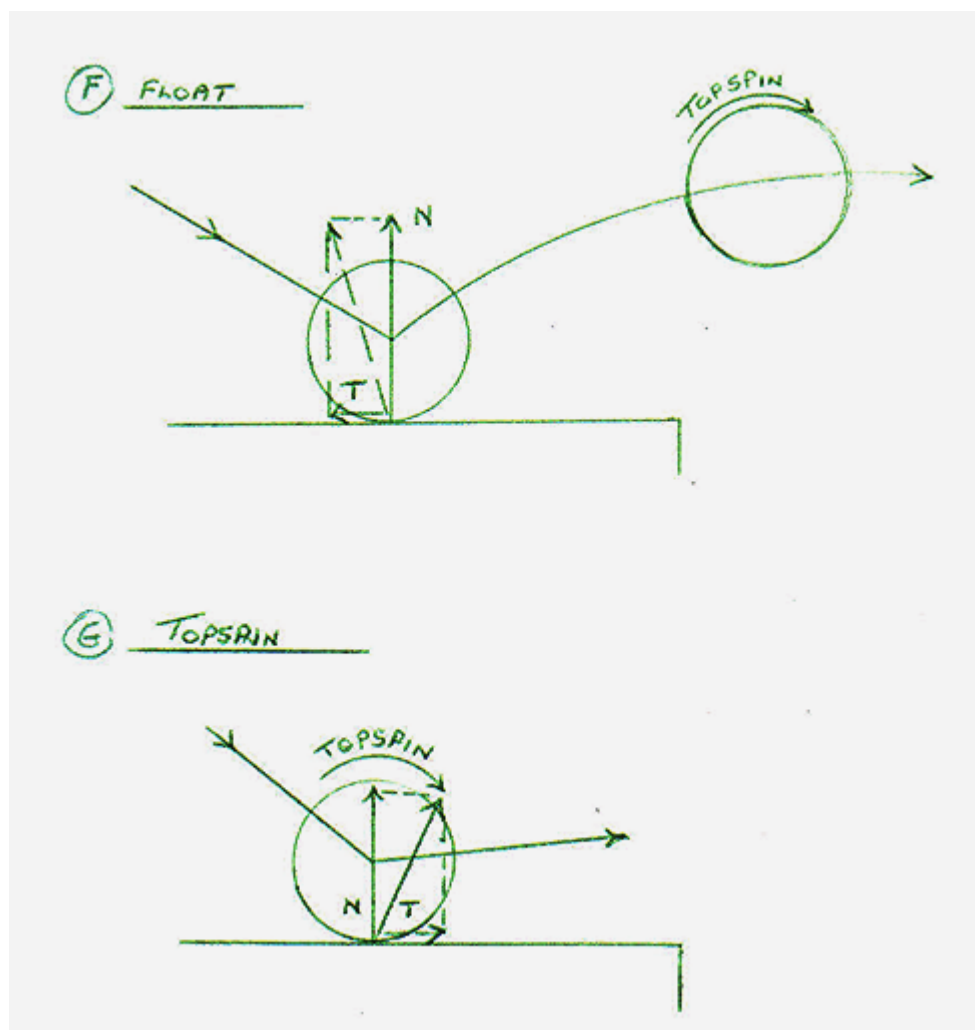
The energy which one imparts to the stroke, the motion energy, can be of two types, rotational or speed value. A smash has strong speed value while a loop has a great deal of both values. In the case of ball/table and ball/passive racket the rotational energy can predominate, dramatically slowing the speed value. Perhaps the most important consequence can be that the reversed rotational energy not only returns a much slower ball but also one that can alter direction quite markedly. In the case of the 'active' racket a new motion energy will be established.

11. BOUNCE ON THE TABLE

The effect which will occur between the ball and the table is partially because of the bounce N (impact speed and angle) and the spin T (amount and type). There will also of course be energy losses (a reduction in speed of

about 10%). The result will be a bounce which can reach a height of approximately 70% of the trajectory's high point in flight.

The float ball will lose speed after the bounce but will acquire a weak topspin due to the bottom part of the ball being held by the table and the top part rolling forward (Diagram F). In the case of strong topspin the ball will acquire forward energy and this rotational momentum will be converted into extra speed (Diagram G). The speed of the ball's movement forwards will increase. The result will be a bounce of less than 70% of the highest point in the trajectory, with a lesser spin but an increased speed (in the range of some 15 - 20%). The backspin ball is similar to the float ball - however the big difference will be the spin factor which will have as much effect as the frictional qualities of the table's surface will allow. Often it can be a question of the ball 'sliding' through. Otherwise there will be a clear 'braking' effect after the bounce and the ball will slow, kick up a little and hang in the air (it can often kick up above the absolute line of sight).



Sidespin has the rotational values at right angles to the table's surface which means directly that as the point of the axis is in contact with the table, there is little or no loss of spin. The ball therefore comes through with maximum retained spin.

The friction between the ball and the table will reach a maximum of around 20% of the impact force between the ball and the table - then skidding occurs. In comparison the friction between the ball and the racket is very much stronger and will reach levels of 50% or more. In the case of a passive stroke where the racket scarcely moves then the effect of the spin against the surface will be extreme.

Reverse rubber is very sensitive to spin and the racket must be at the right angle with reference to the incoming spin and speed. A great deal of topspin will require an extremely closed angle but if the speed is also high then the angle will need to be opened up. In the case of the ball's contact with the racket we are concerned with two types of power. N = Normal power which consists of the bounce and the speed of the ball and T = Tangential power which depends on the spin and the frictional qualities of the racket.

'Braking' or frictional forces can have a major effect on the rotational values (spin) and the rotational energy can be changed, exhibiting itself as an increase in speed or as a dramatic change in direction.

The loop is usually executed with maximum racket speed and as thin a contact as possible. The harder one endeavours to strike the ball (with a closed (topspin) racket or open (backspin) racket) then the more spin one will achieve together with speed. Always bear in mind however the old cliché - 'What one gains in spin one loses in speed and vice versa'.

Interesting effects can also be achieved when one contacts the spinning ball at one of the poles where there is little or no spin - the spin will remain on the return ball but often in a completely unexpected form. This is due to two different axes trying to assert themselves at the same time. A loop against a sidespin ball will result in a topspin return with a sidespin kick.

12. SPEED, DISTANCE AND TIME

Obviously the further you back away from the table the more time you will have to prepare and the more time to set yourself and hit the ball harder. However equally the opponent will have more time (Diagrams H and J). Both show how the ball loses speed over a distance. If two players are each 3 m back the total distance between ball contacts is around 9 m and the ball will slow through the air - this gives over 0.5 s to react which in the case of two fit, skilful players will mean that it will be hard to outmanoeuvre the opponent and win the point.

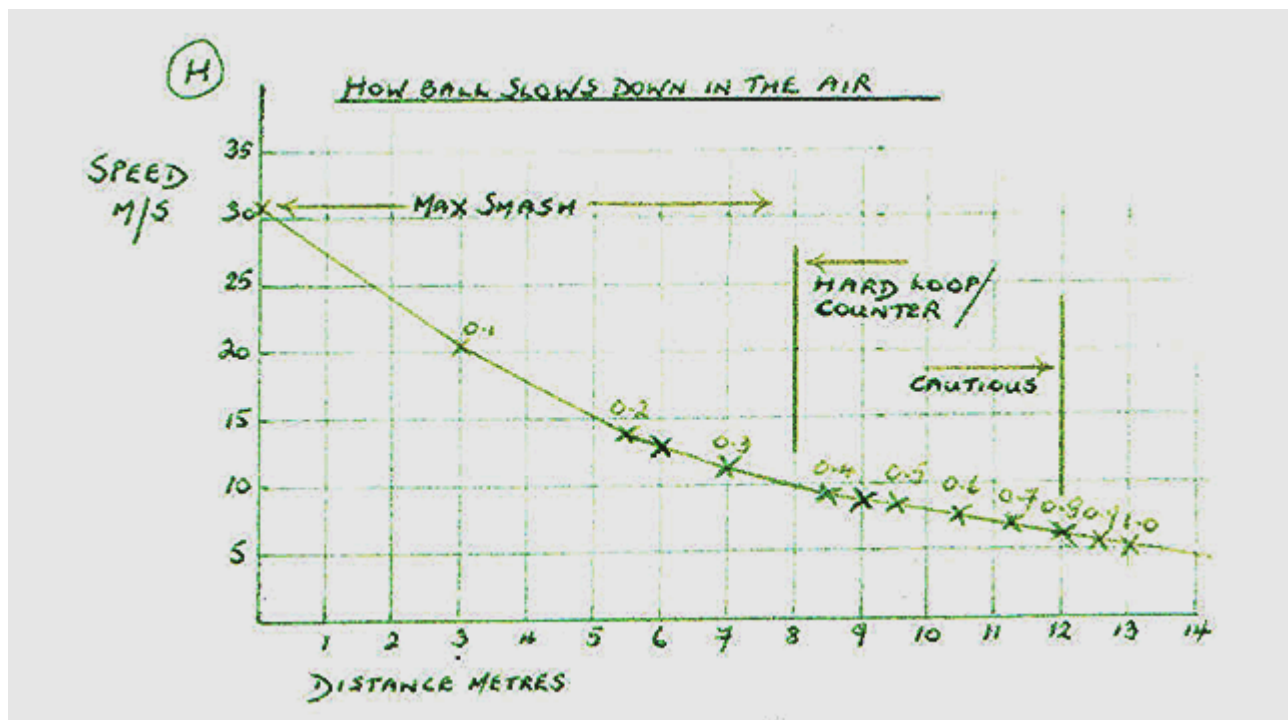
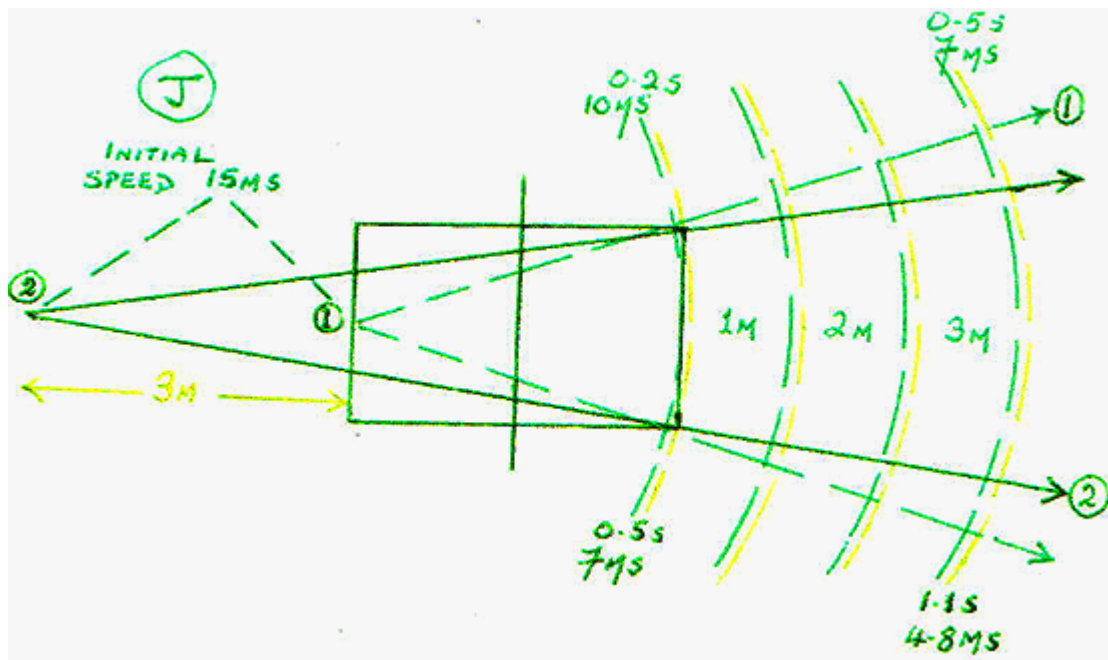


Diagram H. Choose your initial velocity, say 20 m/s which gives you a mark of around 0.1 s on the curved line and a figure of 3 on the baseline. Forget the figures to the left of the 0.1 and work with the right end of the curve. After another 0.2 s (0.3) the distance is 7.0, so the ball has travelled 4.0 m (7.0 - 3.0) and the speed is down to around 11 m/s.



As we can see from (J) there is a big difference looping close to the table and executing a similar stroke 3 m back. If we feed in an initial speed of 15 m/s, ball (1) will reach the other end of the table in 0.2 s or slightly less and will then have a speed of 10 m/s - ball (2) on the other hand will take around 0.5 s and the speed will have dropped to 7.0 m/s. We must also bear in mind that even at relatively slow speeds, say an average of 40 km/h, the ball will cover the length of the table in about 0.25 s which is the approximate limit of human reaction time for the average player.

There are obviously several advantages in playing closer to the table which many top men are now coming to appreciate in the framework of our much faster modern game (the women have used these advantages for many years).

- The angle of play increases.
- The speed of play increases.
- The time to play decreases.

These aspects mean that the opponent has to cover more of the table and more ground in a lesser time and has to react at a higher speed (the time frame can more than halve). With access to information on time, distances and speed (in relation to the ball) one can easily move into the optimum position to make the best use of time and pressure the opponent. Equally such insight gives perception into one's own capabilities and how these should develop.

13. ECONOMY OF MOVEMENT - KEY TO SPEED

Explosive speed is an inherited characteristic and players who don't have it are rather limited in what they can do to train up this aspect. However there is nothing to stop any player only using those patterns which give most economy of movement. It's elementary for example to understand that quick play requires short strokes so that you can recover for the next ball (not so short however that you fail to play 'through' the ball). If in our modern fast game you are attacked hard and have no time, then you must be satisfied with the block return.

Racket recovery is particularly crucial and it's vital that the racket returns to the neutral position after each stroke so that you are ready to play FH or BH on the next ball. It is equally vital that the elbow drops down after the stroke (especially the BH counter) so that the forearm is in the best possible position to move in either direction.

The ultimate style of the player will dictate which type of movement patterns he should use. Close to the table blockers will use many one-step movements or small jump steps. Strong loop players will inevitably use the cross-step to reach the wide ball and defenders should train at moving in and out. However with the modern

game both close and deep, movements which retain a square position are preferable. Movement is one of the most critical parts of any young player's development and yet very few countries in Europe work constructively with footwork patterns at an early age. It is particularly important that you establish a pattern with a young player that can grow with the player, (can a sidestep pattern be easily developed into a cross-step?). It is also a priority in the 'modern' game, where we have limited time that footwork is economical, one big step is preferable to many small ones.

Among the world's elite (especially the Asian players) the FH is still the dominant stroke and many men players will still move more in order to bring this wing into play. (Among the top European men because of the increase in the basic minimal speed many now use the BH from the middle or even from the FH side against the serve. It will be interesting to see if this tactic, which has been common amongst the women for many years, will become the norm in the men's game).

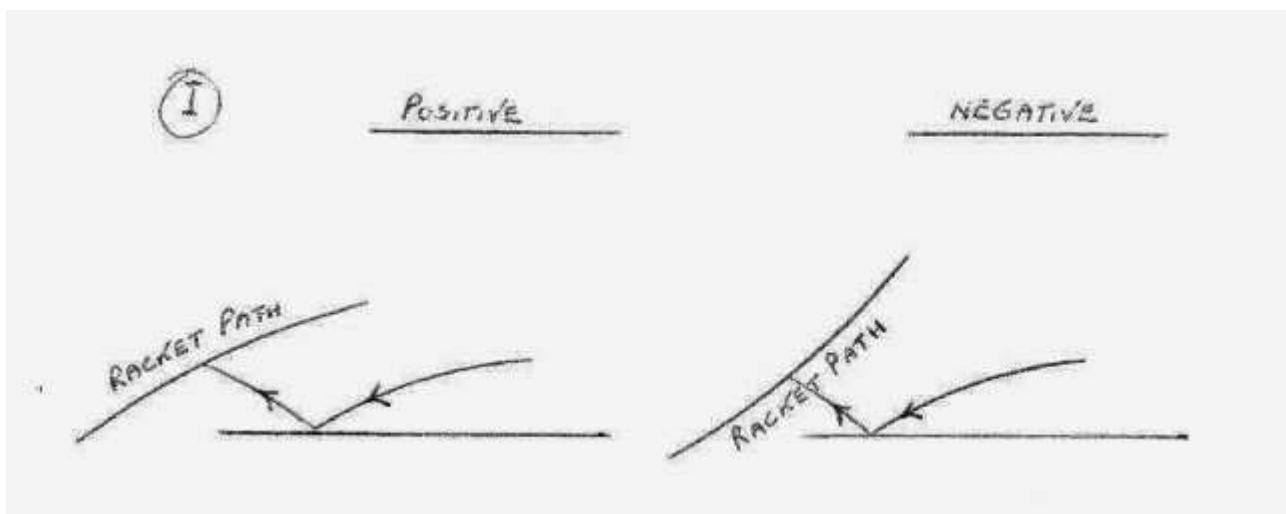
Perhaps here a warning should be issued to women trying to use the FH over the whole table as some top men do. The women's game is rather faster as they stand closer to the table, hit the ball earlier and flatter. Often they have less time to move and to react between shots. Also overall their physical capabilities can be reckoned as between 15 - 30% lower than the male. These factors can make the difference between success and failure at top level.

For a top player to execute strong topspin from FH and BH corners with FH and BH consecutively takes around 0.6 s. However to do the same with just the FH wing will take almost 1.0 s. This is quite a big time difference at top level. FH play over the whole table is asymmetrical (by this we mean one-sided and unbalanced movement). Symmetrical play is clearly superior from the point of view of economy of movement, the only downside being that the BH topspin is generally less powerful than the FH.

A change to more symmetrical play requires that the BH topspin be of the same quality as the FH. This can be achieved by use of what we call the tennis BH. Here with a quarter rotation backwards, taking the ball off the left hip and using good rotation and very fast forearm action, the stroke can be upgraded to a similar power and speed as the FH. Certainly in the future it is becoming obvious that in the light of the speed of the modern game, play will become more and more 'symmetrical' and that this will be the way forward.

14. RADIUS OF THE STROKE AND ANGULAR VELOCITY

A stroke can be executed with a large radius (a straight arm with forward movement) or with a small movement (flick of the wrist). If you use a large action then a small mistake in 'timing' will have little significance, however with a small movement the resulting error in placement will be very apparent. Use small movements over the table and the large action further back where you require more power and precision of placement.



In the case of any stroke where an arc is used we can have a positive or negative arc (Diagram I). The positive arc follows the outgoing trajectory of the ball much more closely and as a result has a higher safety margin. The

negative arc places much higher demands on exact timing. However in the case of the loop against a backspin ball where the racket angle is much more open the advantages or disadvantages are not so critical.

Many players think that it's safer and more natural to have a negative arc with the BH topspin and especially where the feet are more parallel with the end of the table. However for those who want to work with the 'tennis' BH it's important that they have the same positive arc on both wings and don't need to change from one to the other.

15. THE GEOMETRY OF THE GAME

Whether it is a matter of standing right, moving in the right way or placing the ball in the most advantageous position, one can have a great deal of help from pure geometrical analysis. Most players for a start will want to cover around 60 - 65% of the table with the FH side as they can reach further on this wing, and 35 - 40% with the BH.

From the point of view of recovering to the most advantageous position relative to the angle of play, you must assess the total angle available for the opponent's use and move into a position where your right shoulder is on the centre line (the bisecting line). Obviously when playing the FH from the BH corner playing on the opponent's BH diagonal gives the most advantageous return angle.

However with the FH serve from the BH corner this can be placed to either corner - it is only necessary that you move to cover the return possibilities the instant after ball contact is made.

In doubles play the same geometry applies - the only difference is that the one who plays the ball doesn't have to take the return. It is necessary to place the ball in an advantageous position for your partner. A right- and left-handed player complement each other well in this situation as both can often use the FH most of the time. In doubles it is wrong to always try to return to a normal ready position just as it is not profitable if both partners end up wide out on one corner or the other.

Can we use the Body more in Stroke Play?

We often lay much emphasis on the movement of the bat arm in stroke play and acquiring good technique and do not perhaps stress enough or understood the use of the body and legs. With the development of looping and especially counter-looping techniques the player is not only required to strike the ball hard and with power but also to have a high level of control at all times and in a fast moving and fast changing situation. This is not easy. It is made more difficult in that the centre of gravity must start lower with the loop stroke so this entails moving, turning and lowering the body at the same time, all before executing the shot.

It also entails playing the stroke with good coordination and recovering with balance to play the next shot. This is why now and in the future the role played by the body's centre of gravity in striking the ball should assume a higher level of importance. To give full play to one's centre of gravity within the action of playing the stroke, one has to coordinate the movements of the waist and hips with those of the knees and feet. To play with the centre of gravity means that when the player swings his or her racket forward to strike the ball, he or she should consciously use the shift of the centre of gravity to enhance the striking force in the stroke and to make the whole movement more controlled and steady.

In many cases players pay some attention to their waist and leg movements but neglect those of the hip joints. In fact the hips are of rather more importance in that they are much closer to the body part where the weight is evenly balanced, the centre of gravity. It is therefore perhaps a wise practice to 'borrow' an exercise from the martial arts and add a few movements before striking the ball - first pull in and tense the abdomen and turn the hips, then relax the abdomen as you turn the hips forward. With the strength properly applied not only can the player reduce the extent of his or her movements but also enhance the striking force to a much higher degree.

More Agility, Shorter Strokes

At the Worlds, Asian players showed especially in the longer rallies, just how perfect their physical preparation is; most European players were not prepared so well and in most cases they lost longer rallies against Asian players! As we have seen with China, Asian players pay much more attention to speed in their physical preparation, while this kind of preparation is often neglected in Europe. We get the impression that physical preparation in Europe is mostly based just on elements of the physical side such as muscle power, maybe coordination, but agility and specific TT quickness are not practised enough. We have to work much more on speed, there is no alternative and we have to improve in this area. Asian players compared with European players are much faster in coming to the ball, the effectiveness of their shots is therefore much better. Our advice to European players must be not only to practise specific speed on the table but to practise as well basic speed and speed endurance, but above all to pay much more attention to agility. Agility is in particular important when a player has to change the type of stroke which is quite often the case in modern play.

Physical preparation must be good enough in order to enable the player to come to the ball fast and therefore be able to produce a technically correct stroke. Without perfect physical preparation good stroke technique in the game is not possible. When we compare the training of top players in Europe and Asia we must come to the conclusion that Asian players spend significantly more time having top quality training than is the case with European players. The length of training is maybe the same but the intensity and quality of the training are not and these aspects are obviously better in Asia. How this problem can be solved is a task not only for coaches, but for European players as well.

As a result of the world-wide ban on the use of speed glue and boosters, new rubbers have generally lost speed and spin. The strokes and especially the smashes, are not as hard as they used to be. In order to compensate for this, it is necessary to learn to play using the entire body. This is especially important with the FH topspin technique, which depends not only on the movement of the hitting arm, but also on more hip and shoulder rotation and on the player's weight being shifted forwards in the direction of the shot particularly when back from the table.

Because of the speed of the game and the need to play and stay closer to the table the strokes are now shorter and more abrupt leading to more injuries anyway. This was the direction of modern TT even before the big ball and the banning of glue and boosters. But it is unfortunately the case that these measures have accentuated the situation without really making the game more attractive to spectators and the media as was originally hoped.

Achieving Perfection in Performance

It is when the body does things on autopilot that it is most effective. When you start to think about the strokes and especially about technique, you introduce problems, the thinking part of the mind interferes with the subconscious execution of the shot or serve and performance is affected. For a start the automatic reaction is much faster, you only slow things down by introducing the conscious, thinking process. This is why with players who have trained for many years and whose habits are firmly ingrained, you can often only change small aspects. You can only restructure the player's technique by destroying his or her game and starting again. The things that you can think about when you play and think about profitably, are where you are winning and losing points, which serves to use and not to use, free your conscious, thinking mind to operate more in the tactical areas and how to gain advantage here.

Because TT is a very technical sport the basic law is adaptation and counter-adaptation. Each player tries to adapt to the technique, tactics and playing style of the opponent and to avoid being 'controlled' by the way the opponent plays. TT is largely a sport of conditioned reflex patterns where players train to react automatically. This is why new techniques, tactics and unusual styles of play are difficult to cope with. The 'automatic pilot' doesn't work so well any more and the player's reactions are unstable, inaccurate, lacking smoothness and coordination. In fact the player who can keep one step ahead of the competitors in the innovation of technique, tactics or playing style, will have a big advantage (especially now we are playing to eleven up) because the opponent will have difficulty in adapting in time.

The prime skill of TT is to be able to adapt to an ever changing situation. Unfortunately the way we train is often significant in reducing our chances of achieving this ideal. Training is repetition in the right environment, with the right content and the right attitude. As a result of this repetition our strokes become 'grooved' and

automatic. We train so we don't need to think about what we are doing - so that we can in effect play on auto-pilot.

Once we are in this position of playing completely automatically just how are we supposed to handle thinking about something new and different, much less being actually able to cope with and adapt to new aspects? This is the reason why players who have something unusual or unconventional in their game are so difficult to play against and why the Asian coaches, especially the Chinese, are always on the look-out to give their players some extra 'specialty', something that bit different to give them a big advantage over others.

This is of course why it is so vital for coaches to ensure that their players, right from the formative years, have the opportunity to train and play against all styles of play and combinations of material. In this way the 'automatic' reflexes, the conditioned responses, that the player has to work so hard to build up, cover a much larger series of actions and it is rather easier for him or her to adapt to new situations. In other words the content and method of training assume rather more importance than we may have initially thought, especially in the formative years.

Technique for example is the basis of tactics and the development of technique generally precedes that of tactics. Only when the player has mastered all-round technique successfully can he use various tactics to the fullest extent. But also the appropriate use of tactics can allow the player to use his technique to the fullest extent. New techniques will inevitably give rise to new tactics. A thorough understanding of the interaction between technique and tactics will enable us to better understand the vital importance of innovation in tactics in our work with young players.

Another aspect that many players and coaches do not seem to appreciate is that development must be in the right direction for the particular player and that the right training must be devised to enable that player to evolve and mature. Indeed it is the prime function of the coach to unlock the potential of his player. Direction is vital, if the player follows the wrong course for him or her then much of that potential can remain untapped.

How many players really know how to get the best out of their own game, what is effective with their own personal style of play? If you ask players how they win points, what is their winning weapon, they may well know this. But if you go into their style in more detail you get fewer and fewer answers and often little understanding of several important areas. Many players do not even seem to be aware of their most effective playing distance from the table or how much of the table they would cover with the forehand or the backhand for example.

If you start to explore in depth, which serve and receive is most effective with their style of play against designated opponents, how they change against defence or pimplers, ask if they can take advantage knowledgeably of return spin on the third or fourth ball and use elastic energy or the Magnus effect against defence players, often you only get blank looks in reply. How many even know where they are going and more important, how to get there? At a personal level how many players actually comprehend that they are training in the right way for them, with the right content and the right methods?

Even if you become involved with players who have been in their national squads for some years and have played in European and World Championships, often they are still not aware how to get the best out of their own game (especially women players) or indeed where they are going. It would appear that a thorough understanding of the relationship of tactics to technique and the intricacies of personal style development are not considered necessary at national level in many countries.

How many players even know how to train properly and to train in the right way for their type of game? How many have the right attitude and the optimal level of nervous excitement in the training hall to get the best out of the session? So often training operates at a lower and less intense level than it should because the players bring the wrong attitude to the training hall.

A player's consciousness is more important than his or her technical proficiency. Skills can be learned but attitudes and the quality of consciousness are difficult to improve. The cultivation of TT consciousness should be an obligatory theoretical course for all players. Each player should be aware, should be able to 'feel' how he

or she is contacting the ball, how he or she is moving, how his or her own body is performing during play. Many players are in fact quite insensitive and indeed ignorant as to just what is happening with the various parts of their own bodies when they play!

Cultivate awareness in seeking for example the optimal point of impact when striking the ball or in combining 'drive' and 'brush' strokes during play (such a combination constitutes the very essence of TT skills), even in getting the feel of the movement of one's racket during each stroke (being mindful of each stroke you play so that you are aware of the why and wherefore of its success or failure). In many cases the ability to be totally aware of exactly how you are performing, only evolves after some research or exploration into the mental side of the game. In fact many athletes in many differing sports are becoming much more conscious of the value of the 'mental side' of performance, especially now that in many areas we are perhaps closer to reaching the physical limits than we were some years ago.

If you are to be more aware for example of how you function and how your body operates in a playing situation, it is important that you study relaxation techniques and are first able to relax. The beauty about learning to relax completely even if you do this off the table and away from TT, is that soon you become aware of tensions in your body as you play, train or compete. You know yourself better and are then in a better position to control and to take action to change what is happening with your body.

It is quite important also to understand that the ability to concentrate and the ability to handle stress are very closely connected. The ability to focus on the task in hand and not to let yourself be side-tracked is one of the most essential qualities in competition. We must bear in mind too that although we know that the level of performance is affected by tension, we know very little of exactly how. TT is one of the sports that will only tolerate a relatively low level of tension. Too much and it is extremely difficult to perform. Also different phases of an individual match will have differing levels of stress and pressures and we should understand this if we are to be effective.

If you are to aim for the top levels it is critical that you start to analyse your performance and what is happening when you compete and train. This should become a regular part of your development and become a habit. What often distinguishes the elite from the ordinary athlete is the ability to make mental assessments more or less automatically. Any mental programme should be systematic and goal-oriented and it should indeed be on-going and continuous and progressive. This doesn't mean that you need extra time to train, the mental side should indeed be integrated into and become an integral part of your everyday normal training.

No player is going to become extremely successful at the highest levels unless he or she is adaptable enough to contend with all variations of play. Most top players also have strong fortés which help them to win through even against the toughest opposition and they are invariably mentally tough themselves. In fact it is often this quality of never giving up, of extreme stubbornness, which many competitors refer to when they talk about the 'real' champions.

Control of the Racket

Many TT players have experienced great difficulty in producing strong, spinny loops no matter how hard they try to lift the ball, speed up the racket or adjust the angle of the bat at the instant of impact.

There are many ways of increasing loop spin. One aspect however which many players tend not to consider, is the importance of having good control of the racket swing, especially in the preparatory phase and just before the instant of contact with the ball. If you wish to produce a loop that has the qualities of high speed, good power and heavy spin then this aspect is vital.

Generally the faster the bat-swing, the stronger the spin in the loop, but this is not always the case. We are aware that it is necessary to have a 'thin' contact in order to achieve good spin. However if the contact is too fine, we will not produce strong spin, however much force we apply. This is of course because the ball is not given enough friction and it will just slide off the bat surface without being held long enough to obtain the required effect. Let us look at three experiments by way of illustration.

1. Put a slip of paper on a table with a TT ball placed on one end of the paper and the other end which extends beyond the edge held by your fingers. Use a ruler to strike down quickly on the overhanging part of the paper strip. The paper will slide out from under the ball leaving it motionless.
 2. The same as 1. except that the paper is pulled out quickly with your hand from under the ball. As the movement of the paper is slower here it will move the ball a little and give it a little spin.
 3. The same as 2. except that the paper is pulled out slowly at first so that the ball starts to spin and then with increasing speed so that the spin increases and becomes stronger.
- Experiment 1. shows what happens if you get too 'thin' a contact when you try to loop the ball powerfully. The ball just drops off the racket surface.
 - Experiment 2. although a little better is still not satisfactory.
 - Experiment 3. shows us that accelerating the speed of the racket at the moment of impact is vital to improving the spin of the shot.

From these experiments we can see that the quality of the loop depends not just on the sheer speed of the arm and the racket but on good control of the swing. Many of the world's best players, including Ma Wenge, Gatien, Waldner and Saive, do not accelerate the speed of the racket swing until the moment of impact. In this way they are able to produce loops with immense spin.

To control the speed of the bat-swing the looper must fully relax his arm before hitting the ball. Only at the instant of impact should he suddenly contract his arm muscles to produce an explosive force. He should almost in fact try to feel that he has 'acquired' the ball with his racket (that it is being held by the rubber and sponge), before he accelerates the bat up to maximum speed!

Timing over the Table

When you watch many of our young stars performing on the table, one of the first things you notice is the inadequacy of the short and the 'mid-field' game. Usually the power strokes, the loops, drives and smashes are quite strong and well developed, but it appears that youngsters ignore the value of the short and linking play. Yet it is in fact expertise in just these areas which will allow them to get their strengths in during the game.

In almost all cases players are predictable and safe in pushing play - they take the ball at 'peak' or relatively late and give the opponent time to think and to play. In addition they often do very little with the ball, just return safely. By playing in this way they don't obtain any advantage from 'mid-field' play, rather they allow the play to drift into a control situation where both they and their opponents have an equal chance to break out and win the point.

It is vital to retain the initiative in over-the-table play. In this way you can create many opportunities to get in and open up the play. How many players consider the point that there are basically 4 different ways to push - with control, speed, spin or deception? In addition there are all the various timing points from very early to very late. Just think if you combine the different methods of pushing with a variety of timing points, you increase the options enormously!

Quite often at top level players take the ball early so that they allow the opponent as little time as possible. However they use variation in the racket angle at contact to create lesser or greater spin. The opponent then faces a fast return with very much backspin or almost none and has limited time to react. Top players are also good at varying length with the same stroke movement. The half-long serve can be dropped back very short or pushed back long and fast, but both from the same early timing point.

However it is not only early timing that you can use to good effect. Many players overlook the value of very late-timed strokes, which can in fact be just as effective and deceptive. Consider the scenario where you come in to push the ball at a late timing point and just roll the wrist instead and play an attacking shot. Both early and late-timed strokes can be difficult to 'read' as the player has a variety of options and can change from one to the other almost instantaneously.

With the older type of push stroke, with much use of the wrist and the ball taken closer to the body, it was a little harder to create time and room to open on the next ball and to achieve enough back-swing to engineer good spin. This type of push was also often played from a low stance, so if the opponent were to hit the next ball hard, not only was it necessary to move to the ball but also to come up into a counter-hitting position.

It is obviously of particular importance to consider the technique involved in executing early timed push strokes and consider this in the light of how you play the stroke, where the racket finishes and how your execution of this individual stroke will affect the next shot you will play.

The most common modern technique is to take the ball well in front of the body, with little or no use of the wrist. Instead the stroke is executed from the elbow and the primary input is from the forearm. The stance is relatively upright and subsequent movement in any direction quite simple. If you consider this action in some detail, you may well arrive at the conclusion that there are a number of advantages.

Less use of the wrist gives rather more control in early ball play, without lessening the amount of spin you can feed into the shot. It is also possible to use a very fast action with this type of stroke, which makes it difficult for the opponent to 'read' the amount of spin and the length. But most important of all as the stroke is taken well in front of the body and finishes in a central position from a relatively upright stance, it is very simple to switch on to the attack. Because you switch on to the attack from a forward position and the arm is drawn back quickly, not only do you have space to play the shot but also you have good elastic energy input which you can use in the stroke.

The Modern Blocking Game

Over the last few years there has been a shift in emphasis in the blocking game. Blocking used to be more a question of control and waiting for the opponent to make a mistake. Now it is rather more aggressive and the aim is to break up the play and to break out of the control situation and on to the attack as soon as possible.

At the higher levels and especially on the forehand side, the old type 'control' blocking game has almost completely disappeared. However it would be wrong to assume that it is no longer necessary for young players to concern themselves with the block. The original block is in fact the basis for the 'stop', sidespin and forcing strokes, which are used even at the highest levels in world play.

BLOCK TECHNIQUE

Stance

- close to table.
- racket higher than the elbow.
- racket facing the opponent.
- relaxed.
- weight leaning forward.

Execution

- early timing, before 'peak' (especially important to emphasize this with the forehand block, which is almost always too late).
- the weight forward.
- 'closed' racket, but the angle varying depending on the opponent's spin.

After ball contact

return to ready position so that you are in a position to counter-attack.

TECHNICAL TRAINING

The best method of learning to block is by using multi-ball.

1. (1 player). The coach stands a little back from the table and loops with topspin. The player blocks. Begin with light topspin and increase the spin element. Work then at varying the topspin so that the player understands the importance of varying the racket angle.
2. (2 players). The coach plays backspin to player one. Player 1 loops and player 2 blocks.
3. It is often best to use the better player to loop against the player who needs to improve his or her blocking play.

ALTERNATIVE BLOCKING TECHNIQUE

Stance

- close to table.
- racket higher than the elbow.
- racket facing the opponent.
- relaxed.
- weight leaning forward.

Execution

- early timing, before 'peak' (especially important to emphasize this with the forehand block, which is almost always too late).
- start with the racket a little higher in the case of the 'stop', chop or forcing block or a little lower for the topspin block.
- acceleration of the forearm is essential.
- work with a little rotation of the upper body.
- closed' racket, but the angle varying depending on the opponent's spin.
- contact the ball in front of the body and at the back or top of the ball.

After ball contact

- return to ready position so that you are in a position to counter-attack.

TECHNICAL TRAINING

The best method of learning alternative blocking is by using multi-ball.

1. (1 player). The coach stands a little back from the table and loops with topspin. The player trains at 'stop', chop, topspin or forcing block. Begin with light topspin and increase the spin element. Work then at varying the topspin so that the player understands the importance of varying the racket angle.
2. (2 players). The coach plays backspin to player one. Player 1 loops and player 2 blocks.
3. Players can work at 1 or 2 together without the coach.
4. The various blocks can be incorporated into normal on-the-table exercises.

There are of course a number of varying ways in which you can block from control to forcing and all the various chop, 'stop' and sidespin strokes. Try to bear in mind the modern theory of blocking, unpredictability rather than control. As well as varying speed and stroke, think to vary placement and particularly length. The purpose is to break up the control game and to create attacking opportunities and as early as possible in the rally.

Life after Technique

What comes after technique and why is technique important? Let's first look at what technique does.

Technique:

1. Provides you with the weapons to play the game you want to play and to do this to the best of your potential.
2. Is the crucial base for tactical development and for the refining of your individual style.

Many coaches unfortunately focus on technique to the exclusion of almost everything else and fail to understand fully where this leads and to understand the basic relevance of technique in the context of the development of their individual player.

Techniques are fundamental to the development of tactics. But these must be the right techniques for you the player and for your game so that you are able fully to implement the winning tactics which complement your way of playing. In other words you must not only have the right weapons, but you must be able to use these effectively and they must be the ones best suited to you, your character and your individual style.

This of course brings us to a further crucial point which coaches fail to fully appreciate and it is this: technique does not in fact predate tactics and style development. There are many aspects in the early stages of a player's growth which are pivotal to just what he/she will achieve and also determine how far he/she will go. This means that early techniques must be refined in the light of the player's end-style and the tactics he/she will then use in the future. This of course means that coaches should even from the earliest stages work with the 'whole package' and not treat technique in isolation.

What must be identified early on is how the young pupil will play as an experienced performer. The clues will for example be in the character, in the mental and physical strengths, in the grip, the ready position, the mobility and the movement patterns and the ability to play 'body accented' strokes. What the coach must of course fully understand is which techniques are appropriate to the player's end-style and which will be most relevant to the tactics he/she will usually execute in the future.

Selecting and refining the appropriate weapons to suit the player's end-style is very akin to the physical trainer's job. If you ask the top experts on the physical side to devise a detailed training programme for your player their immediate response will be: 'I can't do that, because I don't know how he/she plays. I can give you a general programme to build up basic fitness foundations but on a detailed personal level I don't know whether to focus on stamina, reflexes and explosive speed etc. I only know the best approach if I know in detail how the player plays and how he/she uses the body and to what purpose'.

Equally if you the coach have 3 players with totally different playing styles, for example a backspin defender, a mid-distance topspin attacker and a close-to-table blocker/counter-hitter, then the physical requirements for each will be radically different. But similarly the technical requirements and the forging of suitable weapons for each of the 3 styles will also differ fundamentally. Technique of course doesn't just apply to the stroke-play; it also embraces areas such as footwork and footwork patterns and these too in some cases will differ drastically.

Many trainers unfortunately do not understand the inter-connectivity involved in many areas of TT. Nor do they fully comprehend, especially those who are less experienced, the value and effects of the physical and scientific factors (such as upper body strength, ball speed and spin). European coaches must more fully understand the close relationship between techniques and tactics and that the appropriate techniques must be cultivated and refined so that the player is more easily able to execute the tactics suitable to his/her personal end-style. Only if we do this and try to help each player to achieve his/her individual maximum will we get anywhere near being able to match the Asians.

The 40 mm Ball

The 40 mm ball has a larger surface area so it will suffer more air resistance, which will tend to slow it down in flight. This however is offset by the fact that the ball is heavier and a heavier ball does not suffer so much retardation as a light one. If the weight is increased pro-rata with the size, then the two cancel each other out and the two balls will travel at the same speed through the air. The I.T.T.F. specification for the big ball is not quite a pro-rata increase which will mean that it will travel around 2.5% slower. To achieve the required weight the material for the big ball will need to be slightly thinner. Perhaps the I.T.T.F. recognized that it could be difficult to produce a ball that was consistently hard, for in the quality assurance tests they specified a median

value which is slightly higher. Balls meeting this value will travel only about 1.5% slower. They further specified a maximum value which gives a pro-rata increase, meaning that the two balls would travel at the same speed!

Without accurate scientific testing (this would of course mean testing in the way in which TT strokes are played, where the racket contacts the ball usually at an angle and propels the ball forward) it remains to be seen what can be achieved practically but it would appear that the big ball will travel around 1 - 2% slower through the air. If you just drop a big and a small ball, they will both reach the ground at the same time but the big ball will not bounce up so high. Therefore it is in the reaction off the bat and off the table where any significant reduction in speed is likely to occur. Any specific reduction is not easy to assess because practically balls do not meet the table or the racket perpendicularly and even more importantly contain spin, which affects speed through the air and after the bounce. In some of the initial tests done in the research centre in Ottawa, they found that the harder the hit, the less difference there was between the speed of the big and small ball! Perhaps a really hard hit and the big ball will travel faster than the small one! Indications at the moment are that speed at the fast end of the game has not been affected very much but that speed at the slow end is rather slower.

Most players agree that the ball is more visible, slows down more quickly and tends to dip at the end of its trajectory. It also drops down to floor level rather more rapidly and doesn't 'carry' so far after bouncing as the small ball did, especially with a lesser power input. As far as the ball coming off the racket is concerned, the sponge and rubber combination we use cannot create energy, it can only minimize energy losses. The ball will deform as will the racket surface - such deformation represents a loss of energy and the rebound speed of the ball (other aspects being equal) will always be less than the impact speed. The bigger ball with a larger surface area and the racket surface will both deform more, leading to higher energy losses. A similar situation will occur when the larger ball hits the table, there will be a little more deformation, a little higher energy loss.

It is in the area of spin rather than that of speed where most players are going to notice a difference with the big ball. The critical factor is air resistance which will slow the larger ball quicker, accelerating the dissipation of spin and causing it to 'dip' more rapidly under topspin conditions. The speed of revolution (spin) will be in inverse proportion to the size of the ball. The larger ball will clearly spin slower and less and since any point on the surface will travel further to complete a revolution, the spin will decrease quicker due to air resistance. However there is also the possibility that because of the larger surface area it is feasible that more friction can be transmitted to the larger ball, so that in service, very thin contact or over the table shots the opponent who stays close may face more spin! This is of course an equally valid argument with the hard hit ball but if the opponent takes this at a deeper position much of the spin will have dissipated.

A particularly important aspect is what happens after the ball hits the table. Spin is converted into forward or backward momentum. Topspin will add to the speed of the shot after the ball has bounced - the bottom of the ball stops but the top shoots forward increasing the topspin. With the larger ball where we have a larger surface area contact this will tend to dissipate the spin, but at the same time the bottom of the ball should be gripped more on contact thus increasing the topspin effect after the bounce. Which will predominate? Players seem to agree that the big ball dips more both before hitting the table and after the bounce.

Only months after the introduction of the 40mm ball many manufacturers were already producing quicker or oversize blades and faster glues. One of the answers is obviously to increase the power input so we have more spin and speed off the racket and thus to restore the status quo. But is this really the smart thing to do? Surely we the innovative players should be thinking of how to turn any new situation to our advantage not to restore things to what they were? Do we really want to end up slugging it out topspin to topspin two and a half m back from the table till one or other player tires? If the ball drops rather more quickly, especially with spin and if there's more effect with the slower shots, perhaps we should look into these aspects rather more - spin and variation rather than power!

It is perhaps also of interest to think a little of the difference in the power element between the men's and women's game. We must touch on science here for a brief moment - we know that a modern 'sandwich' rubber racket can be swung in a much flatter plane than the old 'hard' bat, thus giving the ball more forward speed. The harder the ball is hit with this type of stroke, the more topspin it will contain. The sponge does much of the work in lifting the ball over the net and the spin in bringing it down on the other side of the table. However

women don't hit the ball as hard as men and will therefore achieve less topspin effect than men on the power strokes such as the loop drive. At the very highest levels in the women's game those players who use the power strokes are going to achieve less spin through the air, less 'dip' on to the table and less speed off the table after the bounce. It should therefore be rather easier for the close-to-table women players to cope with those who like to back away and topspin from a deeper position.

Is Trajectory Important?

Can you make life more difficult for your opponent by changing the trajectory of your topspin shots? If you lower the trajectory and play as low over the net as possible, then it becomes much more difficult for your opponent to counter with force, especially if you feed in rather lesser power. Faced with a lower, slower ball, he or she is obliged to initiate both speed and spin to play positively and get the ball over and down on your side of the table.

There are basically four different types of topspin trajectory which can be produced by varying the angle of the racket surface, the direction of the stroke, the time of hitting the ball and the method of feeding in force to the stroke.

1. When the stroke movement is directed mainly upwards and slightly forwards, with the racket angle almost at right angles to the table surface, the ball will travel slowly in a high, lobbing trajectory, will bounce a little high off the table and then drop down very quickly as the topspin takes effect. This type of loop can be extremely effective if taken at a late timing and played very short (just over the net) or very long (on the base line) and is a useful weapon against certain styles of play (defenders for example).
2. When the stroke movement is directed mainly forward and slightly upward, with the racket surface tilted forward, the ball will travel fast over a lower trajectory that is almost parallel with the table top and will fly forward over a relatively long distance after striking the opponent's side. Such a loop drive type stroke is usually taken at an early timing point or before 'peak'.
3. When the stroke movement is directed forward and downward the ball will travel very fast and low over the net and dip on to the opponent's side of the table. After bouncing it will 'shoot' forward and dip again, often throwing off the opponent's timing. Such topspins are usually taken at a timing point from just before 'peak' to after.
4. When the ball is given a sidespin element, it will fly in a trajectory that curves forward and sideways and after bouncing, dip away quickly in a downward and sideways direction. Sidespin loops are usually taken at a later timing point.

The trajectories achieved in 3 and 4 are rather superior to those in 1 and 2, although they too may have their uses from time to time. Trajectories 1 and 4 are easier to use with a slower ball.

Technique Without Direction is an Empty Shell

Many coaches seem to spend most of their lives focusing on the technical side. Sound technique in itself is a worthwhile aim but of course not the be all and end all - indeed many coaches do not seem to know where to go next after the technical phase is coming to an end as it surely does. In fact one aspect which most top coaches in Europe do agree on, is that the technical development should be completed by around last year cadet or at latest first year junior.

Technique of course forms the basis for the evolution of tactics and ultimately of style development. Unfortunately bad or incorrectly developed techniques can cripple the player's future progress as he or she does not have the right tools to execute the required tactics or to fully cultivate the chosen style.

Good technique is nice, to be effective is better, to understand how you perform at your best and get optimum results is best of all. Each player has to understand how he or she wins as an individual and all individuals are different. It should therefore appear to be fairly obvious that direction along the right path for you the player is of some importance and that this needs close contact with coaches and other members of your support team and

some considerable and on-going discussion. You the player must also have an input and in some aspects of coaching this should be more pronounced than others - for example only you know whether you feel comfortable or not with the way you play or how positive or aggressive you will choose to be under pressure.

Nor is there as some National Coaches seem to think 'a style of play' to which our players must conform if they wish to reach top level. This is a recipe for disaster for we start to move players away from areas where they have a natural talent and often into areas where they will only ever be mediocre. It is the natural talents of the player which we must direct into the appropriate channels for his or her style, so that the individual player realises full potential. We cannot effectively force players into styles of our choosing.

The content and method of training of players, especially girl players, assume rather more importance than we may have initially thought in the formative years. Why 'of girl players'? Quite simply because there are many more styles and many more 'material' players among the ranks of the women. To play at top level in the women's game requires a high 'adaptive intelligence' and this is not something which happens automatically - it is a capability which must be carefully nurtured and cultivated right from the early years.

It is of course the function of the coach to foster self-sufficiency so that in the long run his services are no longer required. However it is above all vital that with each and every player there is 'continued progress'. Perhaps the single most critical aspect of the coach/player relationship is to promote an awareness that without progress there can only be stagnation. In the final analysis winning or losing is not really important - we learn from both - but the process of growing and evolving is.

The Mechanics of Direction

Direction is about knowing where you are going and how to get there. It's about being effective and knowing what is needed for you to play at your absolute best. It's about continuous analysis and reassessment of your game so that you don't take any wrong turnings on the way. It's about asking the right questions - 'Am I going in the right direction - for me and my end-style?' 'What is new in my game? Am I progressing, developing? What should I be working on to make my game more effective, to achieve maximum potential? How am I going to play as a senior?'

Unfortunately what often happens nowadays is that players are being removed, often at a much earlier age, from their own secure coaching environment with a great deal of individual attention and placed into national high performance squads where the majority of the training is group oriented. Sparring is a high priority but not individual development. Often these selected stars see their own performance and results steadily deteriorating while the not so good players who have managed to avoid the system continue to progress and often to overtake them.

The system of course in many countries is not and never was interested in individuals or only in the sense that it is quite prepared to destroy fifty or a hundred players to produce one European Champion. It is usually a question of the survival of the fittest and the vast majority will be used as the cannon-fodder to achieve this end and are expendable in the cause of developing the chosen few. Players entering the system or having dazzling opportunities presented to them must not be blinded to the harsh truths which are inherent in their acceptance.

Yet strangely enough when you talk to top coaches in Europe and discuss the way forward in terms of developing top talent and trying to compete with the Asians, more often than not the coaches stress the vital importance of individual development and that players should come to select high level training camps in Europe not with their National Trainers but in fact with their own personal coaches. They stress the importance of having the coaches on hand who are actually working on a day to day basis with the players. Coaches from countries as diverse as Ukraine, Germany, Slovak Republic, Sweden, Austria, Poland and Italy are all in favour of much higher involvement by the players' own coaches in any European development programme.

Too many coaches even at National level seem to be biased too towards certain styles or to not fully understand others. Perhaps one of the biggest dangers of being encouraged to play a certain type of game, whether the influence is from coaches, media, other players or role models, is that there is a lessening of the individual input.

What should always be remembered is that all players are unique and they should be urged to accentuate and develop their own personal style and to do what they do best. To imitate others often means that you try to develop areas of your game where at best you will only ever be mediocre.

Some coaches even seem to think along the lines, 'we' in our country have 'our own National style'. This too is a rather dangerous assumption as there is then a tendency to ignore potential which doesn't fit in with the 'National Plan'!

Offensive Play and Spin

When hitting the ball with an attacking shot the bat moves in a forward and/or upward direction. The forward motion projects the ball forward and the upward motion imparts topspin. The flatter the trajectory the faster the ball will leave the racket and the less topspin it will have. The ultimate is the flat hit which gives maximum speed and no spin. Topspin is the most important spin in TT because it gives a greater margin of error when hitting offensive strokes and without it we would not be able to hit the ball so hard when it is at or below net height. Due to the nature of the execution of the stroke in comparison with the drive (more lift) it is easy to use many more timing points and thus much more variation. What many players in the Western world especially women do not appreciate is the critical importance of timing in drive play. A flat hit will have very little margin for error and a slight miscalculation will cause the ball to go into the net or off the end of the table. However a topspin hit can be aimed well above the net and the topspin will cause the ball to dip down and still land on the table, thus giving a much greater margin for error.

Topspin is needed in attack because it gives the ball a downward-curving flight path while maintaining directional control. What is good about a downward-curving flight path? It is much more certain that the ball will hit the table because its final approach is nearer to the vertical instead of almost horizontal as in the flat drive. The gyroscopic effect of the spin gives strong directional control, thus more and more power can be fed into the stroke without greatly reducing the on-the-table accuracy.

An important point is that both backspin and topspin cause the ball to deviate in flight. Test this for yourself. In your own training hall loop the ball hard and long with much topspin - it will dip quickly to the floor during flight then after bouncing will spin forward and run on to the end of the hall. The backspin ball will veer upwards before dropping down, will run forward only a little, then will spin back towards you and can end up spinning back past you. Not only does the type of spin affect the ball in the air but it also affects the way the ball behaves after the bounce.

But why does spin cause the ball to deviate in flight and why do we sometimes have unusual, unpredictable effects after the bounce? This is in fact to do with the interaction of the spinning ball as it moves through the air against the flow of air molecules. (We have all felt air, when we stick our hand out of a car window moving at speed we can feel that air is rather more solid than we thought). As the ball moves through the air different areas of the surface are subject to lesser or greater resistance, the Magnus effect. With topspin the ball is forced down, with backspin conversely forced up. If we take a topspin ball for example, the fast moving area at the top of the ball opposes the air flow and we get resistance or high pressure. However at the bottom, the fast moving area of the surface moves with the air flow, the air molecules speed up and you get low pressure. As a result the ball is forced downwards. At the bounce the bottom of the heavily spinning ball is held by the table, topspin increases and the ball shoots forwards very quickly.

Once the ball has crossed the net some force is required to bring the ball down on to the table - gravity alone is not enough if the ball is travelling fast. This force is provided by topspin which causes the ball to dip. Therefore a hard hit must contain a lot of topspin to bring the ball down on to the table - the harder the hit the more topspin it must contain. Modern bats allow the ball to be hit very hard from below net height because they create sufficient topspin on the ball. This topspin also causes the ball to come off the table very quickly, shooting through fast and low after the bounce.

With the modern racket the characteristics of the sponge and rubber allow the bat to be swung in a different, flatter arc, giving more forward speed to the ball. Because of the spin produced, much more energy can be fed into the shot. In effect the ball sinks into the bat, is grabbed by it and as the bat is moving up and forward, the

ball is projected upwards and forwards too. The surface of the rubber is very tacky so it grips the ball and imparts a great deal of topspin. It is this topspin which causes the ball to dip down on to the table. Another vital point is that for the same bat path, the faster the racket moves, the more spin it puts on the ball. A fast hit will contain more topspin than a slow hit. Most players, especially women, do not understand the importance of spin in hitting the ball hard. Very few women for example ever attempt to play with the same degree of closed racket angle as the men, so how can they hope to achieve the same level of spin as the men? It also means that the variety of topspin trajectories are often more limited in the women's game. How much spin you produce is seen most readily when you play against long pimples and your hard hit comes back with very much more backspin than your slow hit.

Nowadays players have mentally absorbed the fact that topspin makes the ball shoot through fast after hitting the table. When they play against pimples they complain that the ball comes through much slower. Often players have problems coping with the flat hit with lesser topspin. The ball comes off the racket faster, therefore travels through the air faster, but comes off the table slower!

What many players fail to appreciate is that the ball will always come off the bat faster when it hits the bat at a perpendicular angle because the energy losses will be less. However fast and elastic, sponge cannot create energy, it can only minimize energy losses. With the sponge racket the grabbing and lifting effect enables the bat to be swung flatter to give more forward speed, but the flatter angle of attack means there are more energy losses due to a larger depression being made in the surface of the sponge. If the elasticity is increased, so that the ball springs off the racket more quickly, this will almost certainly reduce the lifting effect and the amount of topspin produced so there will be less 'dip' on to the other side of the table.

What players must understand too is that we should consider the relevance of speed over three different areas, speed off the racket, speed through the air and speed off the table. We should also consider how the different speeds are affected by how we play the stroke and then examine the trajectory of the ball. Will a loop ball which has a pronounced arc in trajectory reach the other end of the table more quickly than a flat hit which travels in a straight line? Obviously not unless there is a much greater difference in the power input.

We must also put a little thought into just how much effect the 40mm ball is going to have on our stroke play. Without accurate scientific testing (this would of course mean testing in the way in which TT strokes are played, where the racket contacts the ball usually at an angle and propels the ball forward) it remains to be seen what can be achieved practically, but it would appear that the big ball will travel at around 1 - 2% slower through the air. If you just drop a big and a small ball from the same height, they will both reach the ground at the same time but the big ball will not bounce up so high. Therefore it is in the reaction off the bat and off the table where any significant reduction in speed is likely to occur. Any specific reduction is not easy to assess because practically balls do not meet the table or the racket perpendicularly and even more importantly contain spin, which affects speed through the air and after the bounce. In some of the initial tests done in the research centre in Ottawa, they found that the harder the hit, the less difference there was between the speed of the big and small ball! Perhaps a really hard hit and the big ball will travel faster than the small one! Indications at the moment are that speed at the fast end of the game has not been affected very much but that speed at the slow end is rather slower.

It is in the area of spin rather than that of speed that most players are going to notice a difference with the big ball. The critical factor is air resistance which will slow the larger ball more quickly, accelerating the dissipation of spin and causing it to 'dip' more rapidly under topspin conditions. The speed of revolution (spin) will be in inverse proportion to the size of the ball. The larger ball will clearly spin slower and less and since any point on the surface will travel further to complete a revolution, the spin will reduce quicker due to air resistance. However there is also the possibility that because of the larger surface area it is feasible that more friction can be transmitted to the larger ball, so that in service, very thin contact or over-the-table shots the opponent who stays close may still face much spin! This is of course an equally valid argument with the hard hit ball but if the opponent takes this at a deeper position much of the spin will have dissipated.

A particularly important aspect is what happens after the ball hits the table. Spin is converted into forward or backward momentum. Topspin will add to the speed of the shot after the ball has bounced - the bottom of the ball stops but the top shoots forward increasing the topspin. With the larger ball where we have a larger surface

area contact with the air this will tend to dissipate the spin, but at the same time the bottom of the ball should be gripped more on contact thus increasing the topspin effect after the bounce. Which will predominate? Players seem to agree that the big ball dips more both before hitting the table and after the bounce.

Do we really want to end up slugging it out, topspin to topspin, two and a half m back from the table till one or other player tires? If the ball drops rather more quickly, especially with spin and if there's more effect with slower shots, perhaps we should look into these aspects rather more - spin and variation rather than power! It is perhaps also of interest to think a little of the difference in the power element between the men's and the women's game. We must touch on science here again for a brief moment - we know that a modern 'sandwich' rubber racket can be swung in a much flatter plane than the old 'hard' bat, thus giving the ball more forward speed. The harder the ball is hit with this type of stroke, the more topspin it will contain. The sponge does much of the work in 'lifting' the ball over the net and the spin in bringing it down on the other side of the table. However as women don't hit the ball as hard as men and usually play with a less closed bat angle, they will achieve proportionately less topspin effect than men on the power strokes such as the loop drive. Women will tend to suffer more with the big ball than men, those who do have a topspin game will be less effective because it will be more difficult for them to increase the spin element and thus some of the 'on-the-table' effect will be lost and with it a measure of control. At the very highest levels in the women's game those players who use the power strokes are going to achieve less spin through the air, less 'dip' on to the table and less speed off the table after the bounce. It should therefore be rather easier for the closer-to-table women players to cope with those who like to back away and topspin from a deeper position.

Timing in the Men's Game

The vital importance of timing in the men's game cannot be overestimated. Even though our game is faster than ever before, with the big ball top men have time to get into position and to play the return. In theory two top 20 world players at a distance of 3 to 3 and a half m from the table should be able to keep the ball going for a very long time. What we have to bear in mind particularly is that a TT ball due to its light weight slows rapidly through the air and players have around a second to get to the ball at this distance from the table - this gives them more than ample time to recover and assume a good position for the next ball. If evenly matched, players should have difficulty in winning points with pure power from this sort of distance.

What is tending to happen at top level is that players are winning points from the mid-distance and the one who drops further back off the table will usually lose. Longer serves are coming back into use, especially the long serve to the BH side, as the server hopes to force opponents back from the table into a less advantageous position, or to force them to play a weaker return. The player who drops off the table is compelled to adopt a containing game and the player who dominates from the mid-distance is much more likely to win the points with power and pace, angles or even with use of the stop-ball. The player who retreats also has of course much more ground to cover and will suffer more pressure because of this aspect.

It is important that players observe their own movement patterns critically. Many players for example move diagonally backwards when they are switched from the wide FH to the wide BH - this obviously gives them more time but equally gives the initiative to the opponent and allows their adversary to move in and occupy the mid-distance. Players have to be aware of the position they will move to and take up when they are switched.

Players must also of course comprehend exactly what the 'mid-distance' signifies to them. This will vary dependent on the height, reactions and type of shot the player uses. What may suit Samsonov may well be completely different for Kreanga whose topspin strokes have a pronounced arc. Players should be looking at the position where they feel comfortable and where they are most effective. Mostly this will mean being in the best place to use the incoming pace to maximum effect - this will also of course usually minimise the time the opponent has to fashion a strong counter.

A common tactic in Europe is to make the first attack to the body or the crossover in the hope of unbalancing the adversary, so that a further attack to the wings will force the opponent to retreat from the table and adopt a less favourable position further back. All players must be alert to the purpose of such manoeuvres. It is tactically advantageous in the men's game to occupy the mid-distance, to do this first and to hold this position whenever possible.

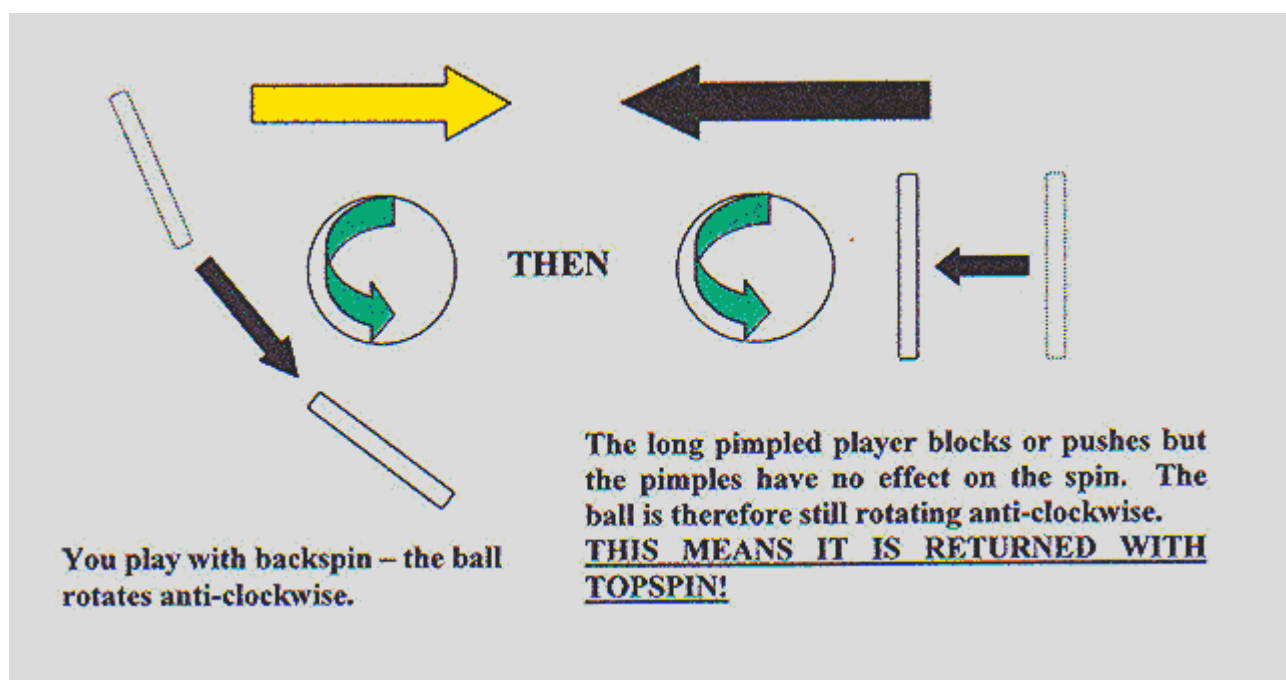
Long Pimples Simplified

In learning TT our actions are 'automated' by constant practice, in other words we train so we don't need to think when we play. In fact we play better when the body is on autopilot. Because of this major difficulties occur when we encounter something unusual, an atypical response. When for example we see a 'push' action our brain interprets this in a fraction of a second as backspin.

If however the ball comes over as topspin then we are confused and all our instinctive, carefully automated reactions are worse than useless. We then have to try and introduce a 'thinking response' into an automated system, which tends to throw everything out of tune. We are again like beginners, faced with a totally new situation. Reactions that we have built up over countless thousands of training hours are not only of no help to us but they in fact actively hinder our understanding of the new situation. This is why training against pimples at an early age is so important, because it widens the boundaries of our instinctive reactions.

The most deceptive long pimple rubber and the one with most effect is without sponge and on a fast blade, so that the ball springs off the blade very quickly. Many players don't understand that what is happening is that they are in effect getting their own spin back. If they for example put heavy backspin on the ball and the opponent pushes the ball back the return will not have backspin (even though his or her stroke is down and forward) but an element of topspin. A long pimples rubber with a thicker sponge will usually return the backspin ball as 'float', while the rubber without sponge can send back a ball with considerable topspin.

This of course occurs because most long pimples rubbers have little or absolutely no friction capability. Whatever spin you initiate, this stays on the ball, because whatever stroke the opponent plays doesn't have any effect. You loop, the ball comes back with your spin still on it, unchanged. You therefore get back backspin. You push, the ball comes back with your original spin, topspin. Your mind only has to accept the fact that whatever the opponent does with his or her racket is completely irrelevant!



Of course long pimple players use their rubbers in many differing ways. Time is always an important factor when trying to read what is happening. The long pimple defender gives you more time to play your shots and to read the spin or lack of spin. The long pimple block player or attacker on the other hand gives you no time at all and this is when life can become very difficult.

Another factor that many players and coaches overlook is that power also affects the return ball. The harder you hit the ball with a closed racket, the more spin you create. Thus the harder you hit the ball against long pimples, the more backspin you get back on the return ball. It is often a better tactic to play slower balls or balls without spin to this type of rubber.

A big problem too is that few if any of us play with 'pure' spin. We loop not only with topspin but with sidespin too. This therefore results in us getting a return ball with backspin and a sidespin 'kick'. This too is the reason for the 'wobbling' effect we often see on the return. The ball is in fact not rotating truly but is spinning in an irregular fashion and the axis changes as one spin or another predominates.

Many long pimple players for example are aware that sidespin is extremely effective with their rubber. They serve a short, heavy sidespin serve and when you push return they in turn block/push the ball back very fast and from an early timing point. You then receive a ball with topspin (from your push) and a sidespin 'kick' (spin still remaining from the serve). You also have little or no time to think or read what is happening.

When playing against long pimples it is in fact your own experience that lets you down. It is not what your opponent is doing with his bat that is important but what you did with your last shot. You therefore have to re-train your mind to remember exactly how you played your last ball.

Predictably this is not easy and even after you train yourself to do it, you will often have lapses, where your 'automatic' training kicks back in and you make the most basic and stupid mistakes. When this happens don't panic, just keep calm, try to remember what you should be doing and have the confidence and courage to do it.

The Journey from Reverse to Material

The job of any coach is to help his players to reach their maximum potential - but the coach must bear in mind that all players are individuals and different and will only achieve the maximum if they allow their own special talents to develop and to flower. There are many different ways to the top especially in the women's game and it is up to the coach to make available a number of alternatives to the player and to suggest the right direction for him or her.

On some occasions the coach can readily see that the player should use pimples by the way he or she executes the stroke (perhaps a 'punching' action on the backhand side). Often however it will come down to what the player can or cannot do with the ball in a match situation. First has the player good technique in both slow and fast loop and drive play and smash on FH and BH sides. Does the player have difficulty in creating strong topspin? In the case of many girls for example, rarely can more than one or two out of every ten create real topspin. If players have difficulty in creating or in controlling spin there can be a good case for material of one kind or another.

There are basically seven differing types of rubber surfaces on the market and we will look at these in some detail -

1. Reverse (normal rubbers Butterfly, Donic, Stiga, Yasaka, etc.) usually with soft rubber sheets and softish sponge around 35 - 40. Used by top men and women in Europe and by the top men in China on the BH side. Very good for looping and the best control for blocking.
2. Tacky reverse (Chinese rubbers DHS, Double Fish, Friendship, Globe, etc.) with sticky rubber sheets and usually a harder sponge (around 39 - 45) than that used by top European players. Mostly used in Asia as a FH rubber for the top men and women. Very few players in Europe use this type of surface, except former Asian players. (Used successfully by Drinkall and Knight in the European Youths).
3. Anti-spin (Made mostly in Europe, Butterfly, Donic, Stiga, T.Hold, Yasaka but the odd Chinese such as RITC 804). Anti can come in two types, almost no spin or a with a little friction. Usually the rubbers are very slow with good control and the ball is slow off the racket.
4. Short pimples are between 0.6 - 1.0 in length (rubber sheet only) and made by both European and Chinese companies, Butterfly, Donic, Friendship, Globe, Neubauer, Stiga, TSP, Yasaka, etc. Short pimples vary very much nowadays and some sheets are capable of creating much spin while others have much less friction. Generally shorter, broader, grippy pimples will create more spin. For maximum effect very soft sponge is a must (30 - 35 but no harder) and top women normally use a thickness of 1.6 - 1.8mm sponge while the men tend to go a little thicker, between 2.0 and 2.3 mm. Men of course hit the ball much harder.
5. Medium or half-long pimples vary between 1.1 - 1.4 mm. and are made by both Chinese and European companies, Butterfly, RITC, TSP etc. These pimples too vary in grip (some have a more anti-spin⁶

surface). The characteristic of half-long pimples is the ease with which players can open against backspin and yet still play a good counter-hitting game with effect.

6. Long Pimples (with friction) are between 1.5 - 1.8 mm. and are made by both Chinese and European companies, Butterfly, DHS, Donic, Prasadha, RITC, TSP, Yasaka, etc. There is an element of friction with these pimples and they are used by many defensive players the world over usually with a thin sponge varying between 0.6 - 1.2.
7. Long pimples with anti-loop effect (between 1.5 - 1.8 mm) are made primarily by two companies, Neubauer and Hallmark. These pimples are hard and feel more like plastic than rubber. They have absolutely no friction and all the opponent's spin is returned. Maximum spin reversal is achieved by using the rubber sheets without sponge although often a very thin sponge (0.4 - 0.6) can be helpful in controlling hard hit balls when in blocking mode.

In the case of all pimple rubbers there must be no less than 10 pimples to a square centimetre and no more than 30 to a square centimetre. In the case of all long pimple rubbers the aspect ratio (ie. The pimple length divided by the pimple diameter) must be larger than 0.9 but not more than 1.10).

If we look at these seven categories in the light of their ability to affect or change the spin on the incoming ball we get results somewhat as follows :

Reverse normal	=100%
Reverse tacky	=100%
Anti-spin	=5 - 12%
Short pimples	=75 - 95%
Half-long pimples	=65 - 75%
Long pimples with friction	=30 - 35%
Anti-loop long pimples	=0%

Misconceptions about Long Pimples

Wobbling/Disturbing Effect

Occurs when a ball is played with more than one spin, for example topspin and sidespin. When this type of ball contacts a hard, long pimple (such as without sponge, plastic pimples and on a fast blade), it then springs off the surface very quickly and the spin already on the ball, remains on it. You therefore get back the same as you applied (but reversed of course, your topspin comes back unchanged, as backspin), backspin, with a sidespin kick. The 'wobbling' effect occurs because you have two differing axes on the ball at the same time and both are trying to assert themselves.

Spin Reversal

Most spin reversal is where you have a red, long pimpled rubber, with thin, hard, widely spaced, plastic type pimples and on a fast blade. The ball kicks off very quickly and there is no time for it to be affected by the rubber. The plastic type pimples have absolutely no grip and when thinner and widely spaced have minimum contact with the ball. Because they are hard they don't bend so much and therefore the ball is not held on the surface.

Herbert Neubauer has done his own exhaustive testing on long pimpled rubbers and the effect of rubber colour and blade weight and speed on return spin. As a result his long pimpled rubbers were originally only manufactured in red because the same rubber in black produces considerably less effect. He has also proved that pimples have most effect when used on a fast and even heavier blade. Of course it is now possible to have double-sided blades, fast on one side and slower on the other to suit the style of the individual player, so having just one fast side is no longer a problem.

Speed Reduction

There can be some speed reduction with thinner and softer pimples which have a cushioning effect during the contact phase. However you must always bear in mind that if the pimple surface is softer and the ball is held longer, then there will be less spin reversal. Most players who are able to play short returns on service receive or in a rally have good feeling in the wrist.

Control

When we consider control we must look at how the player is using the rubber. Long pimple without sponge may have good control when you go back and play defensively, but the same rubber can have control problems when you try and block close to the table. Against a fast loop the ball just springs off the racket too quickly. A layer of sponge will help with blocking control as the ball is held longer on the bat, but you will of course lose effect. Even with a normal, reverse rubber most players will have discovered at some time in their playing career that it's much easier blocking with 2.0mm sponge than it is with 1.0mm.

Effect versus control is always a major point for discussion with long pimple users. In most cases it is a question of whether to try sponge or not and if so how thick. In the final analysis it is often a matter of feeling and 'what works for me'.

Long pimple players all play differently even with the same rubbers and selection of the best playing materials is a highly individual matter and usually one for some experimentation.

Catapult Effect

Catapult effect or speed just doesn't exist. If you throw a TT ball against a stone wall as hard as you can, it will bounce back fairly sharply - if you do the same against a pair of thick curtains, the ball will drop almost directly to the floor. There is just no way a ball will rebound faster off a soft surface than off a hard one. While elasticity levels of both sponge and rubbers will continue to increase we must bear in mind that the resilience of the surface cannot create energy, but only minimize energy losses.

The big difference between the hard rackets of the '50's and the modern sandwich rackets is that the surface is much softer and more 'tacky' allowing the ball to sink in and be gripped. As a result the contact angle used to strike the ball has altered dramatically. Players are able to strike the ball with a much more closed racket angle, which results in very much increased topspin. Using a more closed racket angle not only can players achieve much more spin, but also they have the capability of hitting the ball much harder and still getting it on the table! Striking the ball with a closed racket angle with power means SPIN and the harder the player can hit the ball the more spin will be generated.

What we are able to say is that players nowadays, because of the way in which they contact the ball can feed in much more power, hit the ball much harder, but still get it on the table.

Speed

We must really consider speed over three areas, speed off the racket, speed through the air, and speed after the bounce on the opponent's side of the table.

- Off the racket - For the same incoming speed the ball will always kick off the harder surface more quickly.
- Through the air - For the same power input the ball hit flatter with a 'hard' bat will always reach the opponent's half of the table more quickly than the spin ball which is looped with a pronounced arc and must travel further.
- After the bounce - The flatter ball without so much topspin (a short pimple counter-hit for example) tends to have a similar angle in and out, (physics, angle of incidence = angle of reflection.) The ball may acquire a little topspin after bouncing because the bottom of the ball is held momentarily by the table surface and the top moves forward. However this will not be a significant amount. On the other hand the topspin ball will shoot forward after the bounce and the outgoing angle will be much smaller than the incoming.

In the case of the topspin ball struck with a much more closed racket, the ball will of course have a much more pronounced arc and much more spin through the air. During the last stage of its flight the ball will dip down sharply on to the table. A particularly important aspect is what happens after the ball hits the table. Spin is converted into forward or backward momentum. Topspin will add to the speed of the shot after the ball has bounced - the bottom of the ball stops but the top shoots forward increasing the topspin. We have a much smaller angle after the bounce and the ball shoots forward low and fast, much faster than the flatter ball with less spin.

What has tended to happen over the years is that we are so accustomed to this accelerating effect of topspin after the bounce that we play automatically without thinking about what we are doing. It is when we play against pimped attackers for example and the ball comes through more slowly after the bounce that we often have problems.

The Guide to Long Pimples

What is a long pimped rubber?

On the ITTF list of approved rubber sheets, long pimped rubbers are categorized as those where the aspect ratio of the pimples is more than 0.9. The aspect ratio is arrived at by dividing the length of the pimples by the breadth - a sheet with pimples of 1.8mm length and 1.7mm diameter will have an aspect ratio of 1.06. To be approved the aspect ratio is not allowed to exceed 1.1. This in effect means that very long and thin pimples are not permitted. Most pimped rubbers today have a length of between 1.5mm and 1.8mm. On the 2005 ITTF list of Authorised Racket Coverings there are 79 different long pimped rubbers listed.

The playing characteristics of long pimped rubbers.

The most deceptive long pimple rubber and the one with most effect is red, hard, without sponge and on a fast blade, so that the ball springs off the blade very quickly. Many players don't understand that what is happening is that they are in effect getting their own spin back. If they for example put heavy backspin on the ball and the opponent pushes the ball back with the pimples, the return will not have backspin (even though his or her stroke is down and forward) but an element of topspin. A long pimped rubber with a thicker sponge will usually return the backspin ball as 'float', while the rubber without sponge can send back a ball with considerable topspin.

Once you understand the above then all the rest of the 'hype' about long pimples is very much simplified. So-called spin reversal becomes obvious, you play topspin you get back backspin, you push you get back topspin. Whatever the opponent does with his or her racket is largely immaterial. Even the 'wobbling' balls are easily explained - these occur when you play with a none-pure spin, when for example you loop with topspin and sidespin (as most of us do) and you get back a backspin ball with a sidespin 'kick', simply because there are two different axes both trying to assert themselves at the same time. The most important consideration when playing against long pimples is not what the opponent is doing with his or her racket, but what you did with your last stroke.

Another factor that many players and coaches overlook is that power also affects the return ball. The harder you hit the ball with a closed racket, the more spin you create. Thus the harder you hit the ball against long pimples, the more backspin you get back on the return ball. It is often a better tactic to play slower balls or balls without spin to this type of rubber.

Of course there are one or two other aspects to consider - with some long pimples it's easier to play short or low returns or even initiate some spin. Certain players are able to get much more effect from their pimples than others. The sponge (if used) will also have a considerable impact on what you can do with the rubber. A rubber without sponge will have maximum return effect, thin sponge will often have more control (but less effect) and it's much easier to hit with thicker sponge.

Spin Reversal.

The long pimples rubbers with the most pronounced anti-spin (or spin reversal) effect are quite hard and the individual pimples feel more like 'plastic' rather than rubber.

Wobbling effect.

The most pronounced effect is usually where the pimples are more widely spaced and less 'rubber' comes into contact with the ball. The flexibility of the pimples can also give unusual reactions but of course very soft pimples are easily broken.

Control.

Where long pimples are shorter, wider and more densely packed the control and spin elements will usually be higher. These are of course the reverse characteristics to the more 'anti-spin' types of long pimple. A thicker rubber base will also give a slower rebound speed and more control as will a thin layer of sponge. Softer pimples which are more flexible can help in returning balls short on the opponent's half of the table.

Speed.

We must really define what we are talking about in terms of speed off the racket. Pimples with no sponge will give very quick recoil from the wood of the racket and at times it may be difficult to control hard loops. Pimples with medium or thick sponge will have a slower rebound from the racket and it can be easier to control topspin.

Spin.

Some pimples have a ribbed or rough surface and therefore have the capability to produce spin. This is still relatively small when compared to the spin created by reverse or some short pimples rubbers. Often too the softness of the pimples or sponge or the thickness of the sponge will play a much larger roll in creating spin than the actual surface of the pimples.

Frictionless Long Pimples

The prime question for frictionless long pimple (FLP) players as they look forward to life after the ban should not be - 'Which material should I now use?' Instead it must be - 'Where am I going now in terms of my playing style? How do I want to play?' The change of material will mean of course that many things will change -

1. More alternatives and possibilities will be created.
2. The FH side will need to be adjusted too.
3. Strokes will change and some new ones will appear.
4. Footwork will need to change.

With FLP many players just blocked with the pimples and the rubber caused the opponents to make errors or to return high balls so the pimple player could kill. Now lower returns will mean more use of topspin, more movement and more variety of shots. The game becomes more complicated for the pimple player and new things need to be learned.

Anti can be one of the simplest solutions as it allows the player to use very similar stroke techniques. However anti will give less spin reversal (if the rubber could be made much harder and faster it would help) and will be easier for the opponent to predict. The rubber must therefore be used much more aggressively and a highly active style entails more risk.

Players could also use an approved long pimple with either no sponge or a very thin sponge (0.4 - 0.6) which would be very similar to the anti. There are one or two long pimples (Friendship and TSP) on the market which give some effect.

However with grippy pimples players have to look at direction (where they are going and which type of game they want to play).

- Long pimples (0.5 - 1.2) - more defensive, away from the table.
- Long pimples (OX - 0.6) - offensive blocking/deviour game.
- Short/medium pimples (1.5 - 2.0) - more aggressive attack.

Players must also bear in mind that most or all of these will require adjustments on the FH side and there will be a number of changes for the player to consider.

- Distance from the table; it may be necessary to practice from differing distances.
- Preparation for attacking shots will be different.
- Movement will increase and movement patterns will differ.
- The range of shots will increase -
More topspin, less smash.
Drive/spin with pimples.
Variation in pushes, spin and no spin with differing racket angles.
- Twiddling, pushing and hitting with both rubbers.

Players must now bear in mind that compared with how the game was developed with FLP, spin variation will now be much more important. Now it will not be the characteristics of the rubber which cause the opponent to make errors, but the player's ability to change and influence the spin on the ball which will create openings. This new game will be more difficult and will need more training and practice, but at the same time it will give players more opportunities to do different things and to develop.

With short/medium pimples timing is much more critical if players wish to achieve real advantage. The push for example can be taken very early and played with no spin or very much backspin (depending on the pimple type and grip). Drive play requires the ball to be taken at peak or 1 - 2 centim before for maximum effect. Usually active play needs short strokes over the table and good use of the wrist. Play with short/medium pimples can be dynamic with good variation of pace and many short/long balls, but often requires fast feet and reactions and positive play on the FH wing too to keep the balance.

Fundamentals of TT

- TT is all about CONTROLLING the play (which means being consistent) until you can win the point by some form of CHANGE (more power or spin, different timing, better placement or angle, softer, shorter ball etc). These combinations of change whether in speed, spin or placement are the way our game is going to develop. This aspect of change must be executed by you FIRST before the opponent can do it
- Serve and receive and short play are an essential ingredient to getting in your own strengths - if you can't control these areas then you will not be able to reach a high level. In Europe we are not precise enough in serve/receive and short play and are limited as a result in what we can do with the subsequent ball. Always look for the opportunity to go on the offensive and try to develop your attack system and your own personal style within the serve and receive scenario
- If you move faster you are better placed and have a sounder base to attack strongly. There is then a better chance that your first attack stroke will have quality. If you can play quality shots you will get weaker returns and have more chance to dominate
- Speed is always the most important factor in any style. Speed includes quickness in all areas, bat, body and mind, change and tactics, footwork, reactions and adaptability
- Winning the battle of placement enables you to use your tactics to the fullest extent. Attack should as much as possible be constant and varied and should keep the opponent under pressure in one way or another. However bear in mind that change in any form can keep the opponent off balance and create openings
- To progress to higher levels players must be innovative and creative. Too many players are conservative and fail to take the necessary risks to achieve greatness
- The mentally strong will win the initiative battles
- Always consider the differing types of power, these are part of the various forms of change. Power can be:

1. Full (90% sufficient)
2. Medium (60 - 70%)
3. Using the opponent's force (40 to 50% of own to gain 70 to 80% effect). This is a safe way to be aggressive
4. Absorbing the opponent's power

Note:

- In today's game all-round skills are vital. Top opponents are very quick to see and to take advantage of any weak areas
- Even in defence, keep applying pressure, maintain control, but look for an early opportunity to change the form of the rally and counterattack
- Timing and style will affect stance and movement patterns
- Sequential play is vital - to connect up the 3rd and 5th shots for example, to play sound linking shots and create combinations. Don't get in the habit of playing weak or safe shots before attack; keep the opponent wrong-footed.

Service, Receive and 3rd ball against Left-hander

The forehand serve normally used from the backhand corner can be effective against left-handed players, but it is necessary to think a little more about placement. Left-handers are usually strong in the middle and from their forehand corner for example. You can often however obtain an advantage by serving long, straight to their backhand or short to the middle or at a wide angle to their forehand. Another manoeuvre can be to use the same serve but from the middle and aim to achieve a wide angle both to the opponent's backhand and forehand as in A).

The backhand, reverse or axe serves can be of importance too as they allow you to spin the ball out and away from the left-hander's back-hand, or conversely into the bat arm elbow and either long or short B). The backhand serve can be used from the middle and the axe serve even from the forehand corner. The reverse spin serve (from the backhand) is particularly useful as many players have some difficulty in opening up against an inswinging serve with the forehand.

Serve return and the 3rd ball are critical against left-handed players. They are usually strong on the forehand side and if you allow them to get their strength in, then they can make life extremely difficult. Their topspin often incorporates an element of sidespin and as the ball then spins away to the backhand this constitutes an atypical situation. By this we mean it is not something most right-handers train against and as a result they have difficulty in adapting to it.

A good tactic can often be to play many straight balls particularly down the line to the left-hander's forehand, from your forehand corner or from the middle C). It is important too to use your backhand against left-handed players, force them out wide to the forehand, then play back into the body on the next ball, or wide to their backhand.

As we have said, often left-handers have strong forehands, which they try to use over much of the table. This can make them a little susceptible to the short serve to the middle or wide out to their forehand, especially if the next ball is played long into the corners or into the body. The reverse spin serve can be particularly effective short or half-long to the forehand or middle areas.

Receive tactics are also important against left-handed players. They can be quick to come round on the 3rd ball to loop hard into the corners, so often it is not advisable to push long into their backhand side. A better tactic can be to drop short to the forehand or middle, or to flick or loop long and straight into the forehand corner. This approach pulls them over to the forehand side and leaves them vulnerable to attack into the backhand sector.

As we have emphasized in other articles the prime skill of TT is quite simply to be able to adapt in an ever-changing situation. Most of us train more against right-handers and therefore when we meet left-handed players we find their serves and tactics unusual and it's more difficult for us to adapt quickly. Our automated, 'grooved'

reactions let us down when we have to bring conscious thought into an automatic situation. It is therefore essential that players train against left-handers of differing styles and do this even from an early age.

Often in addition it's necessary too for us to change well-used tactics and table areas which are second nature to us. When we for example meet a left-handed defender with long pimples on the backhand, we are top-spinning on our forehand diagonal to the pimples. For many right-handers this is not a scenario in which they have trained and it requires adjustment. It may also require us to accentuate aspects of stroke-play which we are not normally accustomed to using. For example looping with pronounced sidespin into the left-handed, pimpled defender's backhand will usually cause them considerable problems, but are we capable of using this tactic effectively?

