DriftKurv

Drift

If u want to play a slowish thin-thin cannon, u havta allow for what i call driftkurv or drift -- if u don't make allowancez u might miss the first ball or hit it too thick -- not to mention the second ball.

Nap Effekt

Drift iz the name i giv to the fact that a ball duznt uzually roll in a straight line, due to the nap on the woollen cloths that we all uze nowadayz. Here i refer to a ball rolling with zero sidespin. I think that nowadayz books tend to uze the term ***Nap Effekt***. But this iz ambiguous -- iz it ment to inklood SpinKurv ???

SpinKurv

This iz the name i giv to the kurv experienced by a ball rolling with sidespin. SpinKurv iz uzually more savage than DriftKurv.

Janus Cloth

Unfortunately, the good-old cotton Janus Cloth haznt been available since World War 2. And i think that there iz no good substitute, in any case the major competitionz & leagz & associationz all stipulate & uze napped woollen cloths, so we poor old playerz & clubz hav to kowtow. Alltho the Janus woz too fast -- slower (thicker) would be good.

Riso Levi

Riso iz to blame. He hated Janus Cloth, & he sed amazingly stupid good thingz about napped woollen cloth. Its almost funny, he himself made the same sort of stupid remarks about clothz az he quite rightly accuzed Melbourne Inmann Tom Reece & otherz of making in relation to ivory ballz & compozition ballz. Riso Levi woz smart in some wayz, but hiz logic & science & maths couldn't be judged on a scale of zero to 10, it had to be judged on a scale of minus 10 to 10. Anyhow, i wish he were here today.

Krapamith

What would he say about the Krapamith Ballz ?? He hated ivory ballz, & theze were much superior to the Krapamith Ballz that the major competitionz & leaguez & associationz all stipulate & uze nowadayz. Geet & Mike & otherz all wonder why the 1000'z are so elusiv, it's the krap ballz. They would make plenty with ivory. Iznt it silly, here in the second millennium. The nap we ken almost put up with, but the ballz are a pain in the arse.

Woollen Janus

ProSnooker playerz hav all but eliminated the nap on the cloths that they uze in England, they are virtually playing on woollen Janus Cloths. Drift no longer terrifyz them. Perhaps a slower thicker verzion of theze might appear for us poor old billiardz playerz. But its amazing how the ProSnooker playerz put up with krap ballz, u would think that the penny would hav dropped by now. Actually, i ken forgiv snooker playerz, it duznt really affekt them all that much, unless they miss the 15th black off its own spot & wonder what happened. But billiardz playerz should know better than to put up with krap ballz.

Small Krap

Oh, & i almost forgot, i should hav sed small krap ballz. Koz the ballz are $2^{1}/_{16}$". But Wally & Co uzually played with $2^{3}/_{32}$" ballz. Bigger & heavyr. I praktis with the (large) Bonzolinez & Crystalates, & sometimez i havta put the (small) Krapamiths on the tabl to praktis just before a big match. They look like marblz. And they are very bad for red-ball playerz, & especially bad for nursery cannon playerz. Enuff for now, i am getting off the subject, & i might puke.

Old Books

Strangely, all of the old Billiardz books hav ignored Drift. It woz probably thort to be of littl use in billiardz. Old books do mention SpinKurv (by other namez), but they never mention DriftKurv in any way whatsoever. Hmmmmm. DriftKurv haz been mentioned in almost every book written about snooker, but none haz ever explained its cauze, except to say that it iz due to the nap of the cloth.

Billiardz Arithmetically Treated

Most of the following bits of this chapter are from Billiardz Arithmetically Treated.

Geza Gazdag

The Accomplished Cueman 1991

Geza tryz to explain driftkurv & SpinKurv az followz.....

.....The situation of a ball rolling diagonally across the table against the nap, say from the LH top pocket towards the RH bottom pocket is comparable with that of a runner trying to cross a gently sloping field blindfolded. For a while he would be able to follow a straight line, but as he weakens he would veer off towards the slope. The same sort of thing would happen to the ball if it was sent at landing speed in the said direction : the last foot or so it would veer off 'downhill', as it were, in the direction of the nap. How much? As it depends on the quality and the condition of the cloth, your guess is as good as anybody else's.

.....One would expect a similar effect when the ball is played in the opposite direction, for a blindfolded runner certainly would veer off in the direction of the slope. Well, if the ball deviates at all, it will be negligible.

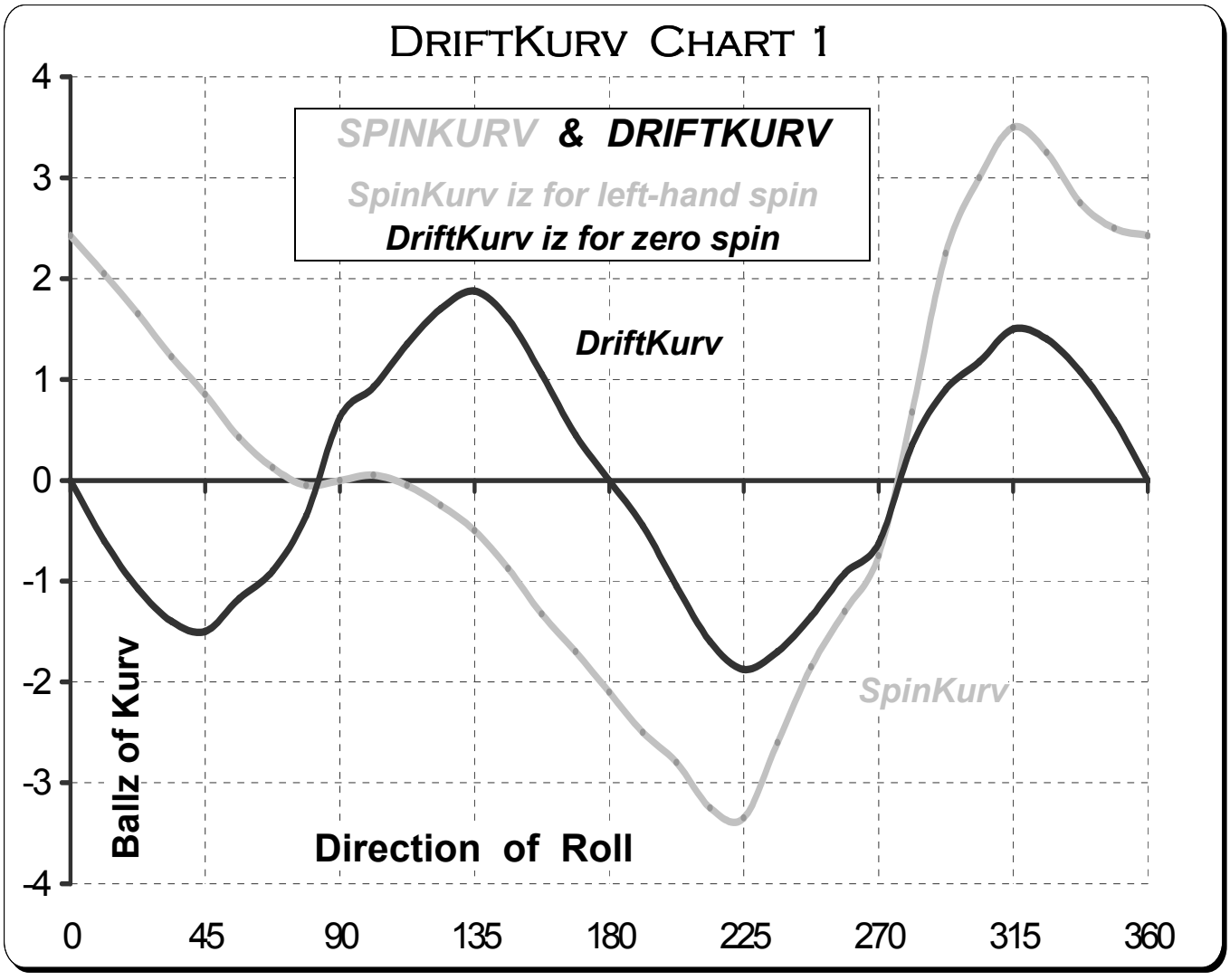
.....This 'slope effect' of the 'nap' is created by its resisting the ball on the 'uphill' side and assisting it on the 'downhill' side, which becomes even more pronounced when the ball is spinning sideways in a humming top fashion. The mechanism of rolling and spinning is identical : half of the ball is moving one way, the other half the opposite way, while the ball as a whole is moving forward. The difference being only in the axis of the rotation.....

.....When the ball is travelling against the 'nap' the side. Left or right, will always be on the resistance side and on the assistance side when it is going down the 'nap'. The deviation on the other hand regardless of the side applied will always be on the assistance side. However, while the deviation from the straight line will be quite dramatic against the 'nap', with the 'nap' it will be next to nothing, if there is any at all.

Tests & Mezurements

DriftKurv certainly playz an important roll in snooker. For example, to pot a red slowly into a middl pocket you might need to allow for the red kurving say a ½ ball in the direction of the nap. The exact allowance required dependz on the direction of the shot relativ to the direction of the nap. Also, most playerz know that there iz more DriftKurv if the cloth iz thick , & less if the cloth iz fine or worn, more if brushed, but less if smoothed by ironing. It iz also somewhat unrelyable. Besidez varying from tabl to tabl drift ken change during a game, az the nap rizez, particularly if conditionz are very humid.

The first step in developing a theory explaining DriftKurv woz to meazure the DriftKurv & the NapKurv for varyus directionz of travel -- the rezults (graffs) are shown in DriftKurv Chart 1. Theze were mezured on a thickish (slow) old style billiardz cloth, brushed (& padded i think) but not ironed. The cloth woz only a couple of months old i think. Cloths are normally replaced when the wear (at the Spot & at the jawz & along the railz) gets too bad -- which at The Cheltenham Club iz at 2 to 3 yearz of age. Most Clubz replace the cloth on the competition tablez each year, altho the newish old cloths are often relayed onto the second rank tablez. Each of the following test rezults (graffs) are the averagez of 2 sets of mezurements taken on 6 & 8 Jan 89 on the one table.



A Few Comments

Kurv In DriftKurv Chart 1 it iz convenient to describe the size of the kurv in termz of ball diameterz, ie minus 1 iz one ball of kurv to the right, plus 1 iz to the left.

Nap The direction of the nap iz taken to be 00 degreez, & the other directionz are meazured clockwize. So 90° iz across the tabl from left to right, & 180° iz directly down the tabl, ie against the nap, & 270° iz across the tabl from right to left.

Max DriftKurv Az ken be seen, a ball rolling somewhat against the nap will alwayz drift in the same direction az the nap. The maximum DriftKurv woz found to be 2 ballz, & this occurred when travelling at approximately 135 degreez. Theze tests were dun on a thickish cloth, brushed not ironed -- logically the DriftKurv would be less on a thinnish cloth. The length of roll woz about 1.5m in each case -- a longer roll would logically giv more DriftKurv.

Zero DriftKurv A ball rolling directly up the tabl (00 degreez), or down the tabl (180 degreez), will roll straight, ie. the DriftKurv iz zero.

Across A ball rolling directly across the tabl (90 degreez) will uzually drift a 1/2 ball in the same direction az the nap.

DriftKurv on an Angl DriftKurv for travel on an angl (ie neither up&down nor across) iz not straightforward. Az kenbe seen, below about 80° the DriftKurv iz against the nap, ie to the right. Abov 80° the DriftKurv iz with the nap, ie to the left. ***With-the-nap*** iz shown by the rangez 00° to 90°, & 270° to 360°. ***Against-the-nap*** iz shown by the range 90° to 270°.

Ironed Cloth Az karnt be seen, on a smooth ironed cloth, the DriftKurv iz uzually less than on an non-ironed (brushed) cloth. In fact, the DriftKurv on an ironed cloth kenbe zero on an angl where a non-ironed cloth would be giving som kurv. In fact, the DriftKurv on an ironed cloth kenbe a little in the opposit direktion, eg to the left instead of to the expekted right. Hmmmmmm.

Doktorz To make thingz even more komplikated -- Tabl Doktorz often lower the level of the top end of the table (ie they skrew down thoze 2 legz) so that a rolling ball tendz to hug the top-cushion. Koz they know that if the Captain seez a ball roll "***uphill***" she will blame the Doktor for doing a krap job -- & the Doktor knowz that she will never beleev hiz explanation that the tabl iz aktually dead level, & that the funny roll iz aktually korrekt & natural -- he will never get another job at that Club. Better to tickle her fancy -- skrew the legz.

What????? Hence everyone "knowz" that a red slowly potted into the right-hand top pocket -- off The Spot -- will drift a little to the ***left*** az it nearz the pocket -- so they are happy to

aim for a bit of the right-hand jaw. But somtimez ***Horror***, at another Club the red goze ***dead straight*** (or even uphill (***right***) a little) & hits a lot of the jaw -- zero pot. What The Hell Iz Going On Here !!!!! Yor Team-Mates are not impressed with yor excuse -- ***It Went the Bloody Wrong Way***. Hmmmmmmm.

Brushing

It gets worse. Yor Clubmates allwayz like to brush the tabl befor the match. They finish off by brushing along (under) the top-cushion, to the left-top-pocket & to the right-top-pocket -- to remoov all of the krap. This brushing along the top-cushion should be done with the tip of a special brush -- taking care not to touch the bed-cloth unduly. But yor Clubmates don't take any care -- therefor there iz allwayz a wide band along the top-cushion where the ***nap*** iz pointing towardz the nearest top pocket. Any red running along the top-cushion allwayz ***acquirez*** som side-spin when it touchez the cushion. Now, koz of the wrongly brushed nap, the acquired side spin will urge the red to kurv ***away*** from the cushion -- due to ***SpinKurv*** -- hence it iz difficult to pot a red uzing slow pace. The Doktor gets the blame again -- hence the Dok skrewz the legz down a bit more, just to be safe.

High Jinks

Cushion-crawlerz had better be aware of what sort of High-Jinks kenbe found near the top-cushion. The level of the tabl -- the bad brushing -- the worn groov along the cushion, especially near the jawz. All ken be life or death to a slow stroke, even at nursery cannon range. Hmmmmmmm.

Slates

Very old tablez uzually hav very old slates -- & very old slates are uzually bent -- & bent slates ken do funny thingz. The Dok karnt gettum properly level -- if he improovz the roll here -- he disproovz it there -- he karnt win. The Frankston RSL No 1 table iz the oldest i hav ever played on -- Alcock No ***537*** i think -- made in about ***1863*** i reckon -- based on No 1 being made in 1852 & Alcock making 50 per year. There are a few funny rollz -- but it iz hard to force yorself to allow for theze rollz even when u know what to expekt. Hmmmmm. My own Duke iz No 981 -- made in about 1870 i reckon -- & a previous owner haz thrown away the old slates & uzed newer onez -- possibly from 1900 i reckon. Hmmmmmmm.

SpinKurv

At first glance finding a good explanation for the cauze of DriftKurv appearz difficult. However, there iz one very good clue. In DriftKurv Chart 1 we hav super-impozed graffs of the SpinKurv & DriftKurv, for comparison. Az ken be seen, the graffs hav a number of differencez, but, there iz also a similarity that will reward further examination.

83°

It ken be seen that the DriftKurv iz ***zero*** at 83 degreez left & at 83 degreez right, & that this iz almost identical to the rezults shown for the ***SpinKurv***.

Holy Grailz

Hmmmmmmm. I think that i ken now ***solv*** thoze age-old arguments -- ie ***what*** cauzez ***DriftKurv*** & what cauzez ***SpinKurv*** -- the Holy Grailz of billiardz theorists.

Cauzez of DriftKurv

Leaning Ball Earlyr i sed that drift occurz to a ball with no spin... But this iz not so.... ***The Leaning Ball*** in Billiardz Arithmetically Treated explainz that a ball rolling across the tabl to the left cushion acquirez clockwize spin & anticlockwize spin when to the right. It woz shown that on a napped cloth there are only two casez in which a ball kenbe rolling with zero spin -- one iz when the ball iz travelling directly ***with*** the nap -- the other iz when the ball iz travelling directly ***against*** the nap. The amount of spin acquired iz not large -- if a marked ball iz uzed it will be seen that the spin axis might be at most say 10° from horizontal.

SpinKurvz So, the DriftKurv iz simply another manifestation of the SpinKurv. ***Both are spinkurvz***. The differencez in the graffs are due mainly (not entirely) to the differencez in the spin rates. See what i meen ??? The tests for the SpinKurv were dun uzing lots of spin, this being applyd with the fingerz. Billiardz Arithmetically Treated explainz everything fully (allmost). Anyhow, befor we look at DriftKurv we firstly look at SpinKurv -- SpinKurv iz the eezyst one -- DriftKurv iz aktually more komplikated than SpinKurv, az we shall see.

FBI Profile of Suspekts

Quest Befor we go ***looking*** for what cauzez ***SpinKurv***, we ken bring in an FBI ***profiler***. But here we hav allready gotten off to a bad start.

Questionz Questionz are difficult --- Answerz are eezy -- we pump out 1000'z of graduates every year who ken answer questionz -- but they aren't very good at asking questionz. I want somwun on my team who ken ask good questionz -- iken buy answerz anytime. Unfortunately we made ***SkoolKid Mistake No 1*** allmost befor we started -- we sed ***what cauzez a ball to kurv*** -- we didn't think that perhaps the ball went a bit straight & it woz we that kurved a bit. Hmmmmmm.

Profile The suspekt iz a force -- or forcez. Here we dwell on the fakt that science duznt know what a ***force*** iz -- & never will know. Which iz lucky, koz science duznt know what ***time*** iz -- & never will know. Which duznt matter -- koz science duznt know what ***consciousness*** iz -- & never will know. Mr ***Quantum*** thinks that a force iz made up of lots of elementary indivizible forcez of a few types. But Mrs ***Relativity*** iz happy to liv in a universe with no forcez at all -- ie where force iz a bending & stretching of time & space -- az iz matter. Anyhow, the FBI'z profile of suspekts leedz to the following list of forcez.

ElectroMagnetik	This force iz in atomik kollizionz -- essential in billiardz friktion.
Gravity	A long-range force -- essential in billiardz.
Nuklear	Short-range forcez (2 types) in the nukleii of atomz -- they don't affekt billiardz.

After we hav found the culprit -- we may call it an ***Effekt*** -- but it iz a force anyhow. We may mention the word energy in our summary -- but ***energy*** never mooved (or kurved) anything in its life -- only forcez ken moov thingz.

Inertial Forcez

Theze are in a way not real forcez -- but they find wayz to ***manifest***. They ken rezult in real forcez -- Electromagnetik forcez mainly. And they ken rezult in a diminishment of a real force -- inklooding Gravity. There are a few types of inertial force.....

Centrifugal Force The forcez exerted on the inner parts of a spinning ball -- exerted by the outer parts trying to fly off. Theze forcez are unlikely to concern us here.

Centripital Force A ball exerts about 140.0gm of force (forget Newtonz) on the bed-cloth -- due to the force of Gravity. But if the earth woz rotating faster -- this force might reduce to 139.9gm. If rotating very fast this force might reduce to 0.0gm -- the ball (& table) might fly off into space. Theze reduktionz arize koz the billiard ball (& table) rotate around the Earth's axis -- the ball wants to fly off (straight ahead) into space. Gravity keeps the ball on the table, & the table on the floor. The force of Gravity iz not affekted -- but it appearz to be -- due to what we call Centripital force. Az i sed, Centripital force duznt ***exist*** -- but it duz ***manifest***. So here an inertial force haz partly diminished the force of Gravity. The mass of our ball iz really say 140.1gm, not 140.0gm. Uken uze an old fashioned Beam-Balance to find the mass of a ball -- it iz accurate anywhere on earth (& beyond) -- but i just forked out $100 for an electronic laboratory scale, & now i find that it iz only accurate at the polez. Hmmmmm.

Coriolis We make the world'z biggest ice billiard table, ***100km*** long, at the ***south pole***. One ice-end iz exactly on the pole, & we take very great care to orientate the other ice-end directly to the north. We hit an ice-ball from the south pole -- direktly at the center of the top-ice-cushion -- which we hav taken great care to align direktly north from the pole. The ball iz suppozed to hit the center of the top-ice-cushion, hard, after rolling for say ***50*** minutes -- & then rebound back to u. But the ball duznt kum back. We send a search party over the horizon to investigate, & they radio back that they found the ice-ball in the ***left-ice-pocket***. The left-pocket iz ***25km*** left-of-center of the table. During the time that it took the ice-ball to reech the top-cushion, the top end of the table haz rotated ***25km*** to the east. So here the *q*ball haz managed to kurv without the existance of any sidewayz force at all. Hmmmmmmm. Our highly paid ***FBI profiler*** haz made ***SkoolKid Mistake No 2*** -- she sed that the suspekt hadtabe a ***force*** -- but here we hav just shown that uken hav lots of kurv with ***zero force*** akting. Hmmmmmmm. But most of our strokes take say ***5*** secondz not ***50*** minutes -- hence the abov ice-ball would hav hit only ***36.4m*** off center. But most of our tablez are only ***4m*** long -- hence in ***5*** secondz the abov ice-ball would hav hit only ***1.45mm*** off center. This 1.45mm soundz like a lot -- & there iz a manned international ice-station at the icy-pole -- & i bet it haz a table. Hmmmmmmm. But most of our tablez are not at the pole -- at the ***equator*** the ice-kurv would be near'nuff ***zero*** no matter how much time the ice-ball took -- it would melt befor it kurved. Anyhow, the Coriolis Effekt iz not a force at all (here) -- hence we should aktually not inklood it in Inertial Forcez -- it should hav its own category.

Inertia The cloth & hairz are unhappy to moov out of the ball'z way -- they accelerate from zero to ????m/s -- at about 1000g (g = accel of gravity) -- & they won't do this without the ball applying some sort of force. This force only occurz where the ball first meets each hair (cloth) -- it acts in a small area (***ring***) at the ***leeding edge*** of the ***footprint***. It affekts the grade of the hill for a ball.

Rotational Inertia A hill or psuedo hill will slow the progress of a rolling ball. But the ball haz topspin. Even az the hill iz doing its dirty work the topspin iz driving the ball higher. 2/7ths of a rolling ballz momentum & energy iz in the rotation -- & 5/7ths iz in the tranzlation. If the retarding force of the hill (ie gravity) iz say 5 Newtonz, then the accelerating force iz 2 Newtonz -- if there iz zero slippage. So, gravity iz retarding the ball -- & rotational inertia iz pushing it on. If the hill woz well oiled -- the ball would reech only say 5/7ths of the hight reeched non-oiled -- & the ball would still hav its original topspin. So here we hav another force. Or if the ball haz a Brake Pedal, the force iz in the other direction (see Rolling).

Rotational Inertia (gyro) Just looking ahead a little. When we look for a force that makes a rolling-spinning ball kurv, this force needzta akt left or right. This force iz likely to be som sort of cloth force -- acting in the footprint.

If the force acts say right, the ball will moov (kurve) to the right. But if the ball iz rolling-spinning (which it iz) then it haz rotational momentum -- with the axis of rotation horizontal (or 10° or 20° or 30° or ??° down or up from horizontal) & at 90° to the direktion of tranzlation (initially). This rightward force will make the rotational axis of the ball turn left -- ie the ball will look az if it iz going (rolling) to the left -- while at the same time drifting to the right (uken check this sort of thing by uzing a bicycle wheel). Something hazta giv.

The turned axis meenz that the ball'z topspin will akt to take it left, ie to straighten it up or even to send it left of the original line -- hence there iz a force pushing the ball left (force L). If the axis turnz, then this must rezult in a deficiency in rotation along the original line of travel -- hence the ball will skid a bit -- there will be a retarding force akting to slow the tranzlation (force B)-- this force will akt to inkreec the rotation (topspin). This iz now 2 forcez (L & B)-- altho theze 2 ken possible be treated az 1 force without inkurring any demerits.

But what happenz in the end -- duz the original Rightwardz force end up by making the ball go (kurv) right -- or duz it end up going straight -- or duz it even end up going (kurving) left. If it endz up kurving left -- then we should be looking for a primary force in the footprint that akts to the left if we want to explain the ball going right. Hmmmmmmm.

SkoolKid Mistake No 3. In fakt, we don't necessaryly need a force (a force left or right) at all. A torq might do the trick -- ie a twisting force -- a bit like 2 oppozing forcez. If there woz som sort of ***torq*** akting in the footprint -- ie akting about a vertical axis -- then this would tend to make the ballz rolling-spinning axis turn up or down -- this would throw the forcez in the footprint out of balance -- the ball would allmost certainly end up going left or right a bit or a lot. Hmmmmm.

Suspekts

Ok now we are getting somewhere -- we ken safely say that DriftKurv iz cauzed by a force or a torq or something that iznt a force or a torq.

Simple Rolling

Befor we look at forcez affekting SpinKurv, we should look again at what we sed about the simple forcez affekting simple roll. Theze were i think mentioned in the Chapter 65 -- Roll.

Cloth-Hill

This we sed woz due to the force exerted by the bed-cloth, in the ball'z footprint, & it inklooded the Trap Effekt, which iz due to the direction of the hairz of the nap, & which we sed affekted the grade-of-the-hill in every direction.

Air-Drag

The air pressure at the front of the ball iz greater than at the back.

Cloth-Air-Drag

This woz made up of the pressure of AirSqeez & AirSuck, where the ball sqeezez or sucks air out of or into the footprint. The horizontal components of theze forcez retard the ball'z progress.

Gravity

Gravity duznt hav a direct effekt on the grade-of-the-hill, ie on simple rolling. The sun & the moon moov about, & the earth spinz, hence in theory the direction of the nett gravitational pull varyz from hour to hour & from day to day. When yor table woz installed it woz installed perfiktly level, at that hour. But the moovments of the moon & sun, & the spin etc of the earth, create changez in the size & direction of the gravitational pull on yor ballz.

Inertial Gravity

In addition to the abov changez, we allso hav changez in psuedo gravity, arizing mainly from centripital forcez. Theze are inertial effekts due to the earth spinning, & due to the earth rotating around the ***sun*** & the ***moon***, mainly the moon. The sun'z gravity iz ***174*** timez az strong az the moonz -- here i am referring to the effekt on the weight of yor ballz. But the sun'z gravity iz largely offset by the inertial force of whizzing around it every ***365*** dayz -- the earth & the playerz ballz are in ***free orbit*** -- hence the sun'z nett gravitational type force iz near'nuff zero. The changez in the size & direktion of the moon'z gravitytational pull & associated inertial effekts (centripital force) are larger than the sun'z -- so this free orbit biznezz iz i suppoze nowhere.

Pseudo Gravity

The force of earth's pull etc changez in size az u wander from the polez to the equator -- or az u change altitude. The G force pulling on a billiardz player'z ballz changez between about ***9.780*** & ***9.832 N/kg*** az she goze from the polez to the equator -- a change of ***0.532%***.

Roll This would affekt the grade-of-the-hill of the Cloth-Hill, a ball rolling ***1000mm*** at the icy-pole might roll ***1005mm*** at the equator.

Half-Ball And it would affekt her half-ball angl -- the ball might spread about ***1mm*** wider befor straightening, for a long-loozer.

Skrew But skrewing would be eezyr at the equator. This ***0.532%*** would help heaps -- koz when the *q*ball gets to the red, it's the rezidual backspin that counts -- 0.532% could make the difference regarding having lots of ***backspin*** or ***zero*** backspin.

Cauzez of SpinKurv

Now here we havta look more closely into the forcez acting on the ballz.

Plumb-Bob

If u are paranoid uken hang a patented Alcock Billiardz Plumb-Bob under yor table. But u would find that u wasted yor money, koz all of this gravity stuff mentioned earlyr would never make more than perhaps an occazional ***1 in 500,000*** moovment in the angle of the bob. This daily or weekly moovment would havta be ***100*** timez az bad to warrant touching the leg-skrewz. Here we are now mainly talking about the affekt on the straight running of a ball, ie the ***kurv***. A 1mm kurv would be potentially worse than a 1mm shortening or lengthening in roll. U would find that any affekt on the grade-of-the-hill itself wouldn't be noticed even if the plumbing woz ***1000*** timez worse. If i skrewed a leg on yor table while u were making a cup of tea, u wouldn't know about it untill yor ball kurved off on som particular stroke. So we ken ignore direkt gravity, & that Coriolis stuff mentioned earlyr -- its negligible (but not at the icy-polez).

There are 4 spinning effekts (or 6 really) that contribute to SpinKurv, az followz.....

1 The RuffEffekt

1.1 Jumbling

A spinning ball leevz a clear trail on a freshly ironed table. Spin ruffs-up the nap -- & this ruffing iz more-so in som parts of the footprint than in other parts. The ruffer parts will then carry more of the ball'z weight -- the hairz are more ***jumbled*** -- hence the ball will tend to fall away from theze parts. The ball feelz that the table iznt level. This allwayz affekts the grade-of-the-hill -- & it somtimez rezults in kurv. This iz the RuffEffekt. ***Friktion*** creates it -- & ***gravity*** duz the work.

It iz difficult to pikture what goze on in the footprint of a rolling-spinning ball. The footprint iz say 7mm in diameter -- there iz allwayz som point in the footprint where that point of the ball acts az a central point -- the photo would show the ball in effekt spinning about that point. Except that the ball iz rolling -- hence a different atom of the ball acts az central point in its turn -- theze lucky points sitting on a line around the lower half of the ball, a sort of Capricorn. So, the nap iz being brushed by the ball in a circular fashion from the nap'z point of view. The brushing iz in 3 different direktionz, on the left side, in front & on the ryht-side. Aktually, uken add to that the backside, different again -- altho the rear of the footprint only carryz about 30% of the weight of the ball most of the time -- so the rear iznt very important here.

1.2 With

If the ball'z brushing iz with the nap, zero jumbling.

1.3 Across

If it iz across the nap, lots of jumbling.

1.4 Against

If it iz against the nap, potentially the maximum of jumbling -- perhaps.

The RuffEffekt probably duznt change much with ***speed*** -- but it inkreecez az ***spin*** inkreecez.

1.5 Un-Jumblez

I suppoze that the RuffEffekt possibly ***un-jumblez*** the nap in som circumstancez -- ie when with the nap -- it ***flattenz*** the nap. If so, it ***dekreecez*** the RuffEffekt in that quarter. A negativ RuffEffekt. Hmmmmmm.

2 The TrapEffekts

2.1 Jumbling Jumbling iz potentially maximized when it iz the ***endz*** of the hairz that contact the spinning ball -- hence the RuffEffekt iz then potentially maximized. But it iz eezy to pikture that the ball iz more likely to grab the end of a hair when it meets the hair at about ***90°***.

Hence the center of the leeding edge of the footprint enjoyz this game when the ball iz rolling against the nap, ie rolling at ***180°*** (00° being direktly with the nap). The ***45°*** part of the left portion of the footprint gets into the act when the ball iz rolling at ***225°*** (mezuring clockwize).

The centerline of the footprint affekts the grade-of-the-hill more-so than the left-most & right-most parts, koz the centerline carryz most of the ballz weight.. But it iz the ***side-most parts*** of the footprint that ken hav a larger effekt on the sidewayz-grade-of-the-hill, ie on the kurv -- hence theze side-most parts are perhaps more important.

But most of this stuff probably belongz to the previous page -- the RuffEffekt. The hardcore TrapEffekt followz.

2.2 TrapEffekt Az we already sed in Chapter 66 Roll --- in some parts of the footprint, in some direktionz of travel, the ***end*** of a hair iz likely to be trapped under the ball, & then the ball rollz over (flattenz) the rest of the hair. When the end of a hair iz trapped like this, the hair cannot bend or yield in its normal simple eezy fashion. The hair develops a ***wrinkle*** -- it duznt flatten so eezyly -- theze hairz take more of the ***weight*** -- if at the side, the ball kurvz (downhill). This complements the RuffEffekt.

Trap Effekt iz logically at its maximum at ***180°,*** & very much reduced at other directionz. But here again, it iz the action in the side-most parts of the footprint that haz a greater effekt on kurv -- hence it iz anglez other than 180° that hav ***most*** effekt.

Zero TrapEffekt TrapEffekt must hav allmost zero effekt when the ball iz travelling between ***00°*** & say ***80°***, & between ***280°*** & ***360°*** (360° iz 00°).

No Spin Needed The thing about TrapEffekt iz that it duznt need any spin -- a ***rolling*** ball ken suffer lots of TrapEffekt.

Spin But spin ken hav a big effekt on TrapEffekt -- in fakt there are a few thingz that ken happen az followz.....

2.3 TrapEffekt Clearly, spin ken inkreec TrapEffekt in som parts of the footprint for som direktionz of travel -- the hairz are pulled around to a pozzy where they are better trapped (not intentionally).

2.4 Negativ TrapEffekt But even more-so, spin ken pull hairz around to where they are not so well trapped.

2.5 Un-TrapEffekt And even more-more-so, spin ken pull direktly on a hair, & hence reduce the TrapEffekt, & this reduktion duznt need any grabbing of the endz nor pulling around to a differenct angle.

3 Janus Cloth Effekts

On a napless cloth, eg the cotton cloth (Janus) of the 1920'z & 30'z, a ball spinning with left side (clockwize) will kurv a 1/2 ball or thereabouts to the right az it slowz & stops. A ball spinning with right side will kurv to the left. I call this the Janus Cloth Effekt. Janus woznt made after WW2, but there iz nothing in the rulez requiring u to uze a Krappy-Nappy-Woolly cloth.

A napped cloth (ie with a direktional nap) givz rize to much stronger effekts than the Janus Cloth Effekt. But the Janus Cloth Effekt iz allwayz in there somwhere none-the-less -- even tho u karnt allwayz see it. The Janus Cloth Effekt iz weak, however it iz very interesting & helps our understanding of forcez acting on a ball.

There are i think 3 possible Janus Cloth Effekts. Each iz due to the ball skidding left or ryht under the influence of out-of-balance friktion forcez in the footprint. Befor looking at the 3 types --- we firstly look at the Janus Cloth Effekt in a general way az followz.

General Stuff on Janus Forcez

The line of the effektiv supporting force of a ball rolling along a yielding surface acts throo a point near the center of the footprint -- but this point iz actually slightly ahead of the center of the bottom of the ball.

The vizible roll-spin-axis iz the rezult of the combination of the roll-axis & the spin-axis. Spin friktion forces in the footprint act to slow the spinning. The theoretical spin-axis iz not vertical, the axis passez throo the center of the ball (i think) & it passez very very near to the point in the footprint where we sed earlyr that the effektiv supporting force passez throo.

The friktion forcez rezisting spinning tend to be in balance. Any out-of-balance force acting left or right etc will rezult in the spin-axis shifting so that balance iz restored. I uze the ryht-hand-rule to help me to vizualize the torq & axis & shift involved -- the fingerz are the spin & also the torq, & the thumb iz the axis.

But the friktion forcez are never in balance, not while the ball iz rolling. Az the ball slowz, the grade-of-the-hill inkreecez or dekreecez -- this changez the weight supported forward & aft of the plane of the spin-axis -- this changez the size of the friktion forcez, it iz the sidewayz friktion forcez that interest us.

For clockwize spin the friktion forcez act anticlockwize about the spin-axis. The friktion forcez are at a maximum at the very bottom dead center of the ball where the footprint iz deepest & the pressure iz greatest. Here they act mainly to the right (or the left) & they overpower the weaker forcez forward of the plane of the spin axis, acting mainly left (or ryht). And so, the ball skidz to the right, hence the kurv. A ball spinning anticlockwize would kurv left.

3.1 Friktion in the Leeding Edge

Remember earlyr when we looked at Inertial forcez. We sed.....

Inertia The cloth & hairz are unhappy to moov down out of the ball'z way -- they accelerate from zero to ????m/s -- at about 1000g (g = accel of gravity) -- & they won't do this without the ball applying force. This impakt force occurz where the ball first meets each hair (cloth) -- it acts in a small area (***ring***) at the ***leeding edge*** of the ***footprint***. It affekts the grade of the hill for a ball.

This impakt force in the leeding edge iz not very large -- & it dekreecez with speed. Az it iz in the leeding edge of the footprint, it must giv rize to a sidewayz friktion force oppozing the spin -- for left-hand-spin this sidewayz force would act to push the ball to the left. Az this force dekreecez (az the speed dekreecez) the frontal sidewayz friktion force (acting left) bekumz less than the sidewayz friktion force in the rear (acting ryht) -- hence the ball moovz (skidz) to the ryht. This new unbalanced torq acting on the ball rezults in the spin-axis dipping towardz the vertical, untill the leftward & ryhtward forcez equalize. But by then the ball haz slowed som more -- & the whole process haztabe repeated -- etc etc.

3.2 Moovment of the Support

There are 2 scenarioz ----- (A) the grade-of-the-hill ***dekreecez*** az speed dekreecez ---- (B) the grade-of-the-hill ***inkreecez*** az speed dekreecez. We will follow throo with A -- scenario B would leed to a kurv in the opposit direktion (i reckon that B iz there, somtimez).

As rolling slowz, the area of contact at the rear growz az the rebounding cloth gradually takes more of the weight. Consequently, az rolling slowz, the friktion force in the rear increasez, and, for clockwize spin, pushez the ball even more so to the right. However, this effekt duznt bekum great. Koz az the rear of the contact gradually takes more weight, the supporting force in effekt moovz towards the vertical az the ball slowz. The spin-axis followz -- hence the area of contact forward of the axis increasez -- hence the friktion force acting left increases untill the leftward & ryhtward forcez equalize. But by then the ball haz slowed som more -- & the grade-of-the-hill haz dekreeced som more -- & the whole process haztabe repeated -- etc etc.

3.3 Near the End

Near the end, just befor rolling stops, there iz another little burst of kurv. If the ball iz still spinning az rolling diez, the rear now starts to take a much greater share of the weight --- which rezults in inkreeced friktion in the rear --- which sendz the ball to the ryht. This force imbalance allso rezults in the spin-axis dipping towardz the vertical , & when the ball stops it iz perfiktly vertical -- or at least it iz in the vertical plane -- altho som funny thingz ken happen depending on just how much spin there iz. Anyhow, here we are talking about some very weak forcez & weak kurvz. And we are talking about a Janus Cloth -- a krappy-nappy cloth creates forcez which uzually overpower the Janus Cloth Effekt -- but az i sed, it iz still there anyhow, it allwayz iz.

What Books Say About Janus

I hav kum across a few referencez to Janus Cloth in old books, saying that a ball traveling with side on a Janus Cloth kurvz az if going against the nap on a napped cloth. But most of theze escape me for now. However, i did find the following.

Geza Gazdag

The Accomplished Cueman 1991

Geza mentionz the Janus Cloth. He sez that an old-timer told him that side on a Janus Cloth had the opposite effekt to what it had on a napped cloth. Which iz what i hav just been saying. But Geza bit the old-timerz head off. Hmmmmmmmmm. Geza sez.....

.....I did manage to find an old timer

who said of the Janus Cloth & the absence of the nap.....

.....they had to cope with the side having the opposite effect to what it had on the nap cloth...

Geza doesn't believe him & sez.....

.....I told him that on a napless cloth the side has no effect on the bed of the table therefore one can hardly talk about opposite effect.....

Arthur F Peall

All About Billiards and How To Pot 1925

..... if you play a slow or slowish ball with strong side on a woollen cloth, the ball will turn in the direction of the side when running with the nap, & in the contrary direction when running against the nap. On a napless cloth, the ball always turns in the direction of the side it carries...

Obviously, Peall got it wrong. He (& Newman) got konfuzed with swerv -- u karnt avoid putting on a bit of masse effekt whenever u uze side --- the less horizontal the cue the more the swerv.

R M Geyer Precision Billiards 1927

.....the surface of this cloth influences the course of the cue ball in the same manner as the surface of the woollen cloth does when the ball travels with the nap.

I don't think Geyer ever played on a Janus cloth in hiz life -- he did vizit England briefly -- i am sure that he merely read Peall'z book & he simply relyd on Peall'z say so. The paragraff on Janus Cloth woz thrown in (in panik) just befor he published -- so pay him no heed. Hmmmmmmmm. What woz Geyer'z first name -- i did see it in The Billiard Player. Michael Ferreira told me that Geyer woz an unknown quantity in India, no one appearz to know anything about him, a Phantom -- but we all know that Geyer used to vizit Thurstonz. Hmmmmmm.

4 Air in the Footprint

4.1 Air-Sqeez & Suck

In Chapter 66 -- Roll -- we talked about how Air-Sqeez & Air Suck in the cloth (in the footprint) affekted the grade-of-the-hill for a rolling ball. We didn't mention it at the time --- but theze same forcez ken allso (i ken allmost say must allso) rezult in changez in the sidewayz grade-of-the-hill -- ie what Senior Wranglerz call Kurv -- here i am talking about a rolling ball.

There iz no need to repeat this rolling stuff here. Just re-read this Air-Sqeez & Air-Suck stuff with an eye az to how it might rezult in a different air pressure on the left or the ryht of the ball -- no problem.

4.2 SpinKurv

For a spinning ball, Air-Sqeez & Suck still play the same game -- altho spin-friktion will allmost certainly modyfy som of them som of the time (ie inkreec or dekreec them). U should re-read thoze previous pagez on the RuffEffekt & on the TrapEffekt with an eye az to how they might modify the Air-Sqeez & the Air-Suck.

Cauzez of DriftKurv

All of the abov SpinKurv stuff applyz allso to DriftKurv, the only real differencez being in magnitude. But DriftKurv haz at least one other effekt happening.

5 NapSkid Effekt

Fifth Cauze

But, there iz a fifth cauze, not related to spinning. Do you remember ***The Coin Conundrum?*** (in Billiardz Arithmetically Treated). This explained how the sliding hairz of the nap, cauzing the Leaning Effekt, also cauze the Turning Effekt & the Nap Skid Effekt. Theze 2 effekts obviously apply to ballz allso (az for coinz, albeit less-so).

5.1 Turning Effekt

The Turning Effekt iz too insignificant to be called the fifth cauze. It haz a large effekt on a coin but littl on a ball koz, (a), leaning producez spin on the ball & this limits the ability of the sliding hairz to exert their full effekt, (b), friktion in parts of the contact oppozez the effekt, & (c), any surplus of Turning Effekt iz all lost due to the action of the forcez arizing from the accompanying sideslip.

5.2 NapSkid Effekt

The Nap Skid Effekt iz the fifth cauze. It haz a small but significant effekt dezerving mention. It tendz to make the ball skid in the direction of the nap, ie towardz the top cushion.

Thin-Thin Cannonz

Az i sed, if u want to play a slowish thin-thin cannon, u havta allow for DriftKurv, if u don't make an accurate allowance u might miss. In the following drawing, DriftKurv 2, we show the DriftKurv for varyus anglz, on the top-cushion, firing away from the cushion, & firing towardz the cushion.

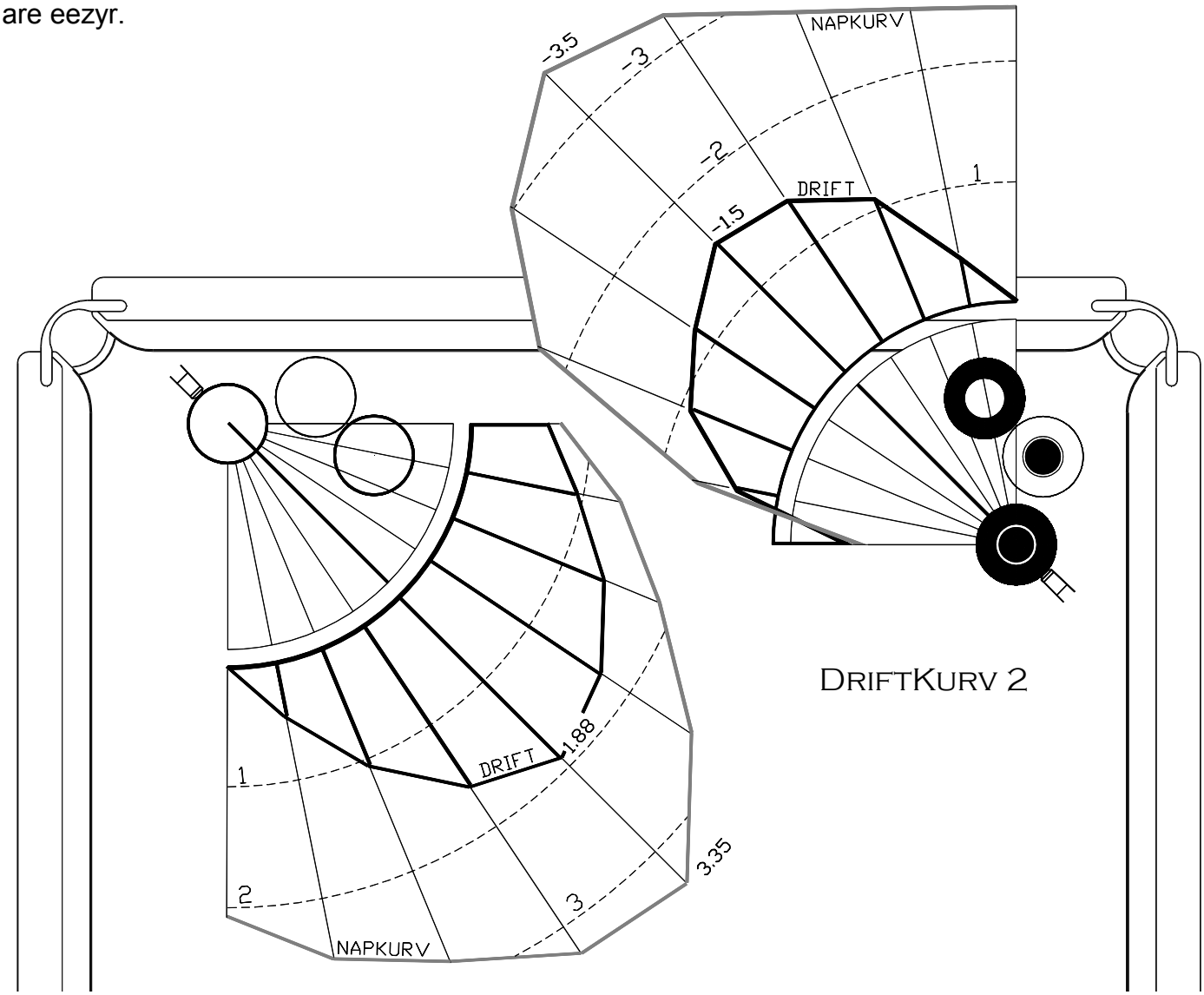
Firing away from the cushion, DriftKurv iz to the left, which helps u, & thin-thin cannonz are eezy. The drawing also showz the SpinKurv for right-hand-side. Right-hand-side iz induced in the qball due to the contact with the first ball. Firing away from the cushion SpinKurv iz also to the left, & so it also helps.

Firing towardz the cushion, DriftKurvkurv iz to the left, & SpinKurv iz to the left, & so they both make thin cannonz harder, & so the valuez are shown az being negativ.

Az a vizual aid, the first object-ball showz the effekt of DriftKurv. If the central half iz completely white then the DriftKurv iz at its maximum & helps. If the central half iz completely black then the DriftKurv iz at its maximum & hurts. The more white the better.

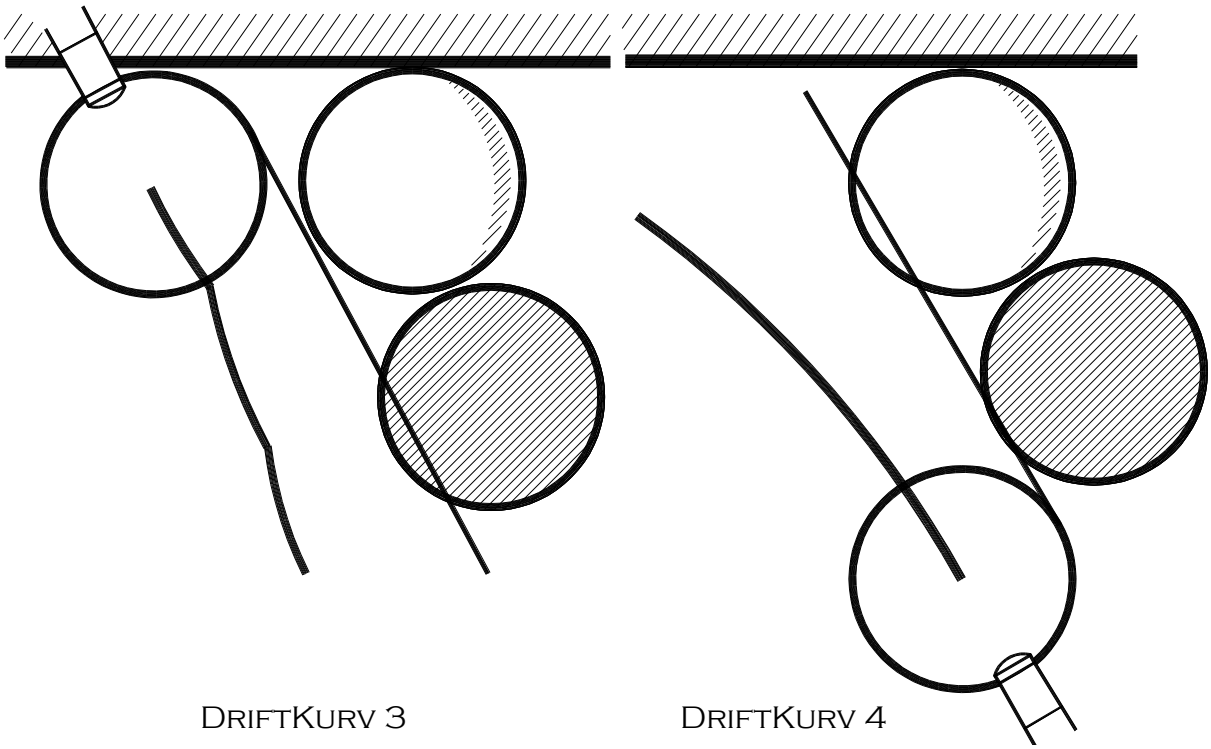
The second object-ball showz the effekt of SpinKurv. If the outer half iz completely white then the SpinKurv iz at its maximum & helps. If the outer half iz completely black then the SpinKurv iz at its maximum & hurts. The more white the better.

The qball showz the combined effekt of the above. The more white the better, ie thin cannonz are eezyr.



DriftKurv 2

Top Cushion ThinAlongz



DriftKurv 3 DriftKurv 4

DriftKurv 3 showz that DriftKurv (& SpinKurv) helps when firing away from the top-cushion, on this angl. Uken even aim wide of the first object-ball, az shown.

DriftKurv 4 showz that DriftKurv (& SpinKurv) hurts when firing towardz the top-cushion, on this angl. Very thin cannonz are often impossible --- the qball seemz to be repelled by the yellow.

In relation to the amounts of DriftKurv in DriftKurv 2, & the amounts of SpinKurv, the figurz mentioned are only indicativ. The amounts of DriftKurv, ie 1.5 ballz etc, were the meazurements for when a ball rolled a distance of 1500mm. Whereaz our littl thin-thin cannonz involv a roll distance of only say 20mm to the first object-ball, & then another say 55mm to the second ball.

Also, for a roll distance of 1500mm, the qball'z DriftKurv iz made up of DriftKurv in the first part of the journey, plus DriftKurv throo the middl part of the journey, plus DriftKurv in the final part. Mainly the DriftKurv in the middl part. But for our 30mm & 55mm trip, the DriftKurv iz mainly made up of the DriftKurv in the first & final parts, the middl iz missing so to speak. So don't take too much notice of the exact figurz etc.

I reckon that conducting some special littl short-range tests, to get actual & accurat meazurements for nursery cannonz, would be difficult & would drive me krazy (or krazyer), so i won't even think about it.

The main thing iz that u should be aware of the nap & the dangerz, & that u should make some sort of allowance. U will fall into the trap less often, &, when u do, at least u will know what bit u.

In addition, the amounts of DriftKurv & SpinKurv depend on the thickness etc of the cloth. A well-ironed cloth, & a thinnish cloth, would hav lower valuez. In fact, if u iron the krap out of the cloth, it iz possibl to get DriftKurvs of nearly zero for some anglz with-the-nap. DriftKurv against-the-nap iz not so inconsistent.

Az i mentiond earlyr, DriftKurv includez some SpinKurv, & SpinKurv includez some DriftKurv, but they do tend to negate each other. It a bit hard to xplain here. Best read Billiardz Arithmetically Treated. Put it this way, if the qball haz a lot of side-spin, then there iz in effekt zero DriftKurv, all of the kurv iz due to SpinKurv. Anyhow, az i sed, don't take too much notice of the exact figurz.

I watched Mathew Bolton, from Perth, win the 2004 Australian Open at the RACV Club in Melbourne, hiz third win. Mathew got perfikt nursery pozzy lots of timez, & played just a few, pretty well, but didn't flog them, being content to break away to top-of-the-tabl play. But what i did notice, on one occazion, iz that he played for a thin-thin cannon, with the nap, ie the dangerous direction, & missed. Mathew looked a littl puzzled. Perhaps he woz xpecting the same sort of inwardz kurv that helps us when playing against the nap. If so, then this chapter will help him to avoid this sort of error. Anyhow i think he woz interested in getting a copy of Cushion Crawler'z Bibl. Mathew'z girl-friend woz intrigued by the chapter on Corner G-Spots (now called J-Spots).

Mathew knew fellow Perthonian, Bob Marshall, who died earlyr in 2004. And i know Bob could play nurseryz pretty well, koz Jack Wilkinson told me. Jack woz a referee, & he sadly iznt with us any more either. Jack sed that he warned Bob on 70 cannonz (this must hav been in the Australian Championships). Bob woz impressed & after the match told Jack that he would be happy for him to referee all of hiz matchez.

Jimmy White Snooker Masterclass

This haz the best chapter that i hav read on DriftKurv

The following excerpts help to illustrate this effekt:

.....`I still hear far too many players walk away from a perfectly good tabl that has a perfectly good cloth and say: `Did you see that one roll off? Diabolical!' Sometimes this iz an excuse for a bad shot, but most of the time it iz the nap at work.....

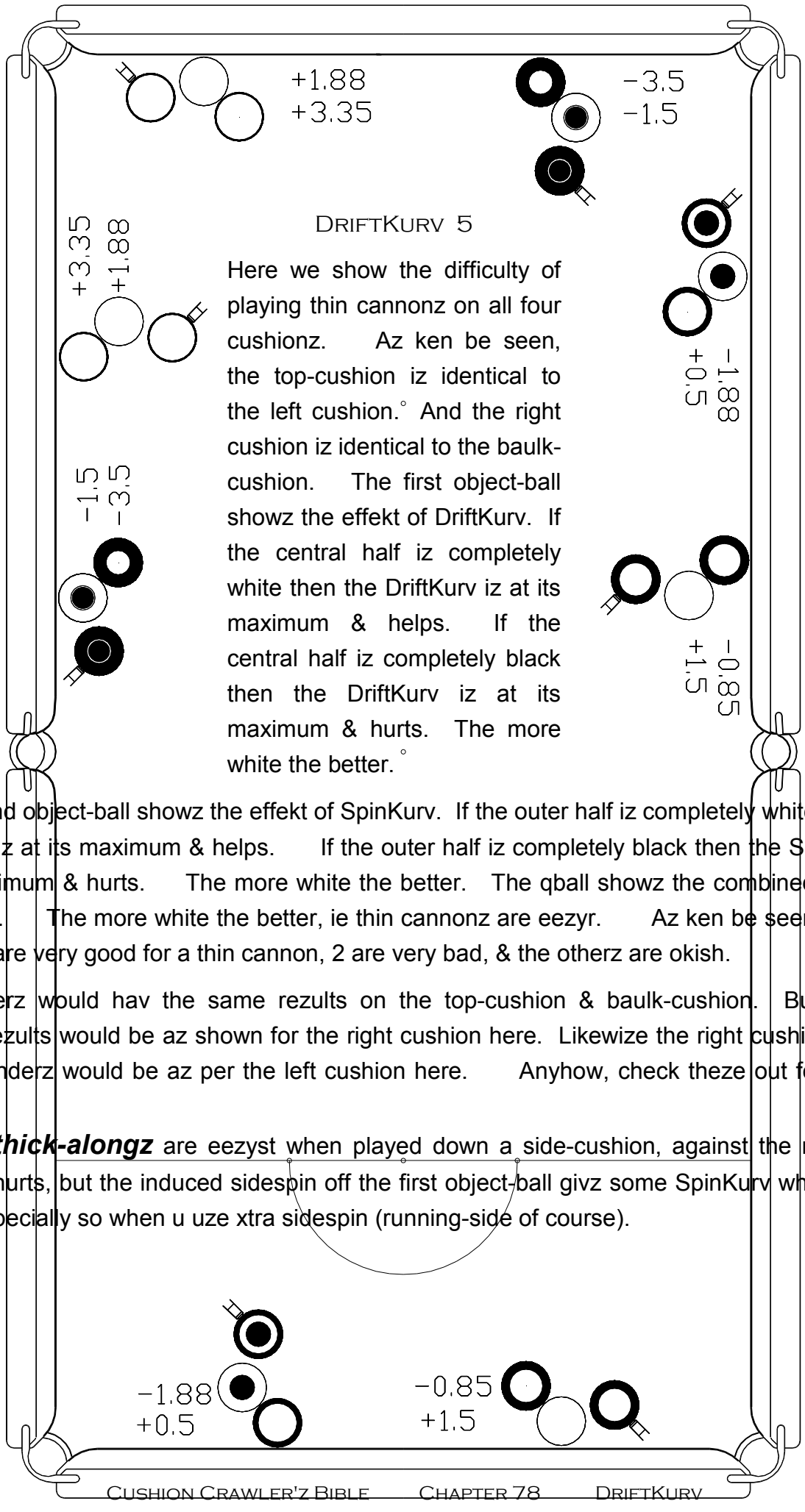
..... the fibres of the nap are acting like a barrier that iz trying to stop balls played from the top of the table from going into baulk, and pull them towards the top cushion instead.....

..... every time you roll a ball on a snooker table, the nap will try to pull it towards the top cushion.....

..... Balls played along the baulk cushion will wander away from the pocket. A ball played along the top cushion will hug it, and even come back on line if it bounces out slightly.....

..... When you watch professionals on championship tables, you will notice hardly any nap effect at all. This is because the cloth they use is super fine with very little nap. These cloths are not suitable for clubs, because they can't stand up to the wear and tear of constant use. Clubs usually go for thicker cloths with a heavier nap - hence more roll off and the more you need to allow for it.....

Sweet or Sour



DriftKurv 5

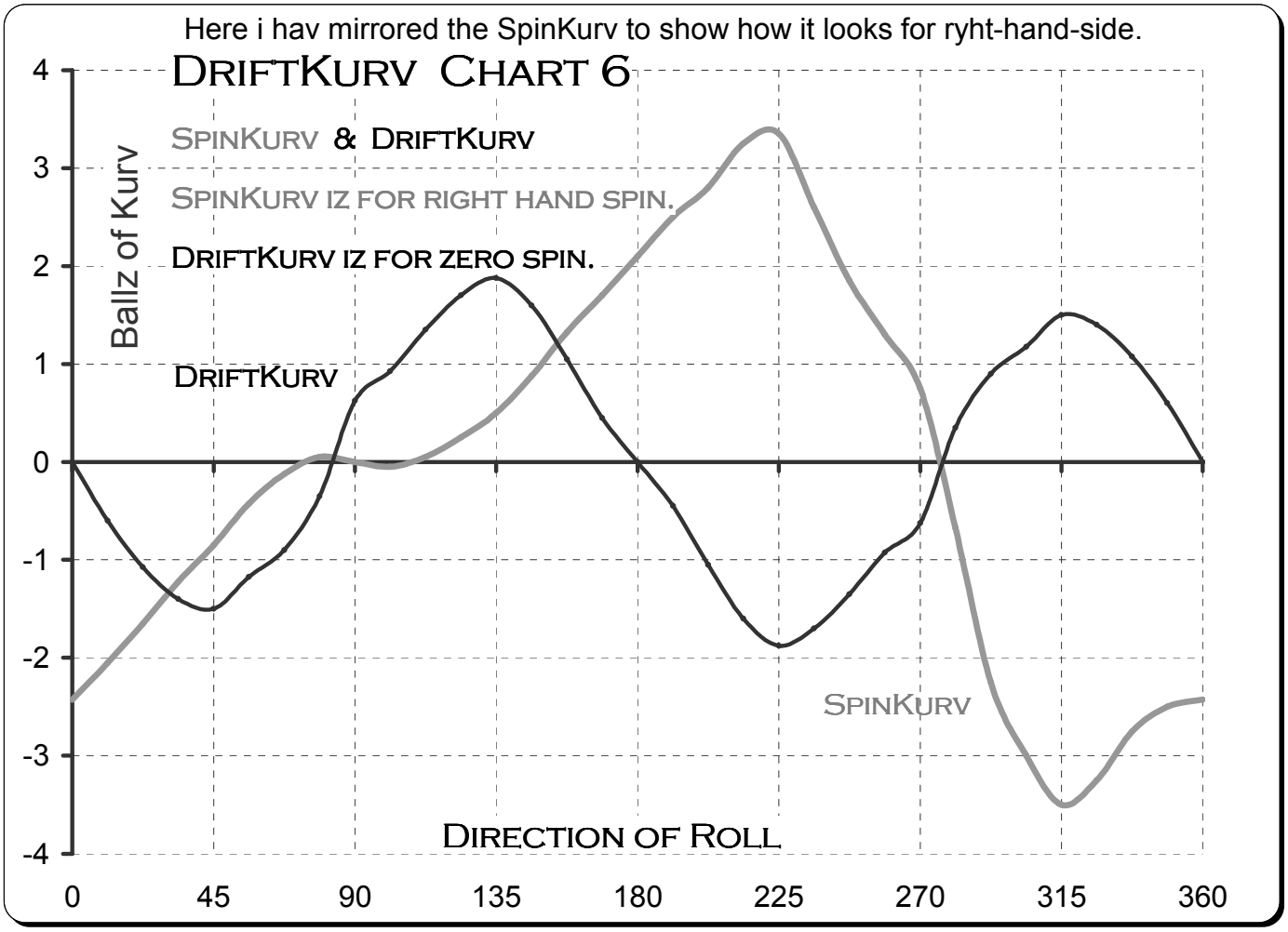
Here we show the difficulty of playing thin cannonz on all four cushionz. Az ken be seen, the top-cushion iz identical to the left cushion.° And the right cushion iz identical to the baulk-cushion. The first object-ball showz the effekt of DriftKurv. If the central half iz completely white then the DriftKurv iz at its maximum & helps. If the central half iz completely black then the DriftKurv iz at its maximum & hurts. The more white the better.°

The second object-ball showz the effekt of SpinKurv. If the outer half iz completely white then the SpinKurv iz at its maximum & helps. If the outer half iz completely black then the SpinKurv iz at its maximum & hurts. The more white the better. The qball showz the combined effekt of the above. The more white the better, ie thin cannonz are eezyr. Az ken be seen, 2 of the 8 pozzyz are very good for a thin cannon, 2 are very bad, & the otherz are okish.

Left-handerz would hav the same rezults on the top-cushion & baulk-cushion. But the left cushion rezults would be az shown for the right cushion here. Likewize the right cushion rezults for left-handerz would be az per the left cushion here. Anyhow, check theze out for ya own tabl.

Actually, ***thick-alongz*** are eezyst when played down a side-cushion, against the nap. The DriftKurv hurts, but the induced sidespin off the first object-ball givz some SpinKurv which helps. This iz especially so when u uze xtra sidespin (running-side of course).

Here i hav mirrored the SpinKurv to show how it looks for ryht-hand-side.



DIRECTION	SPINKURV LEFT HAND SPIN	SPINKURV RIGHT HAND SPIN	DRIFTKURV
0.00	1.50	-1.50	0.00
11.25	1.13	-1.13	-0.35
22.50	0.85	-0.85	-0.53
33.75	0.65	-0.65	-0.55
45.00	0.45	-0.45	-0.63
56.25	0.18	-0.18	-0.55
67.50	0.00	0.00	-0.45
78.75	-0.10	0.10	-0.15
90.00	0.00	0.00	0.38
101.25	0.05	-0.05	0.43
112.50	0.00	0.00	0.60
123.75	-0.13	0.13	0.85
135.00	-0.25	0.25	1.00
146.25	-0.50	0.50	0.85
157.50	-0.83	0.83	0.55
168.75	-0.95	0.95	0.20
180.00	-1.05	1.05	0.00

DIRECTION	SPINKURV LEFT HAND SPIN	SPINKURV RIGHT HAND SPIN	DRIFTKURV
180.00	-1.05	1.05	0.00
191.25	-1.10	1.10	-0.20
202.50	-1.20	1.20	-0.55
213.75	-1.40	1.40	-0.85
225.00	-1.35	1.35	-1.00
236.25	-1.10	1.10	-0.85
247.50	-0.85	0.85	-0.60
258.75	-0.60	0.60	-0.43
270.00	-0.38	0.38	-0.38
281.25	0.38	-0.38	0.15
292.50	1.40	-1.40	0.45
303.75	1.50	-1.50	0.55
315.00	1.50	-1.50	0.63
326.25	1.50	-1.50	0.55
337.50	1.50	-1.50	0.53
348.75	1.50	-1.50	0.35
360.00	1.50	-1.50	0.00