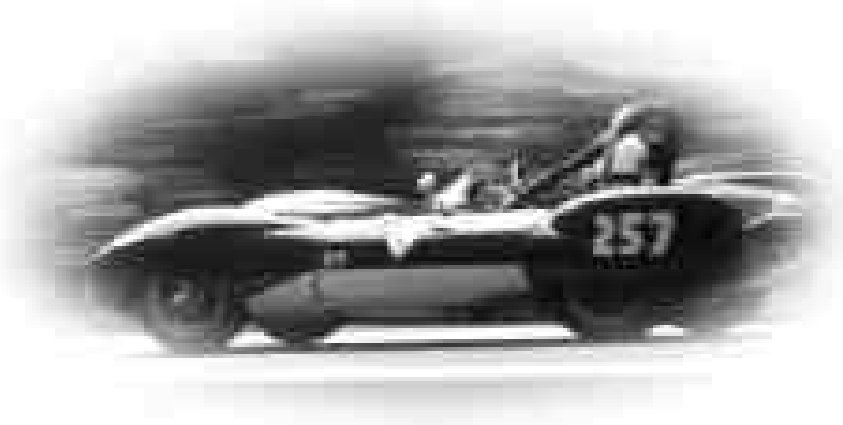
HSR

HISTORIC SPORTSCAR RACING, LTD.



Historic Sportscar Racing, Ltd.

Racing School

Driver Instruction Manual

What does it take to make a fast car go fast?

It means pushing the car to its very limit - and sometimes beyond - while avoiding the crash, the spin, the bobble that nixes the entire effort.

There's more to driving than *FAST*.

We're talking *ART*, here.

Michaelangelo used a hammer and chisel.

Rembrant used paint and brush.

Juan Manuel Fangio used throttle, steering wheel and brakes.

All were artists and *ALL* became legends. They drew crowds who admired their skill and longed to emulate these legendary heroes.

Sculptors and painters easily can chart their progress. Their successes and mistakes are recorded in stone and paint.

A stopwatch or winner's flag helps a driver gauge his skill but they offer no understanding of good moves, better moves or "bleaah" moves.

A driver needs to be able to examine "*THERE is where I can improve*", and "*THAT needs to be changed*".

With such an examination he can accelerate his search for the *ART* in his driving performance and understand those split-second maneuvers that evaporated as they happened.

E. Paul Dickinson

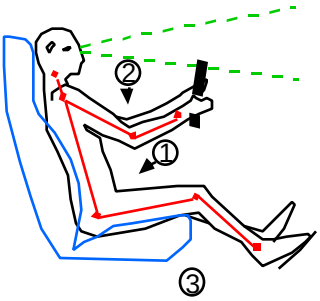
Driver Instruction Manual
by E. Paul Dickinson

TABLE OF CONTENTS

Part One: The Driver

Proper Seating Procedure

1. Do not sit on the seat, sit IN it! Push your rump and the small of the back firmly into the seat by pressing against the "dead pedal" with your left foot. This effort will anchor the seating position and allow the freedom to turn the steering wheel instead of holding on to stay in the seat.



2. Adjust the seat so the heel of your hands rest on the top most spot of the steering wheel with completely outstretched arms. This enables you to reach the most distant point on the wheel with a bend of your elbows. All major controls in the driver area should be reachable without leaning forward. Check the gear shift for a comfortable reach to your highest gear. It is also important to check mirror adjustment.

3. With a slight bend to the knees be able to fully depress the pedals with no interference from the seat or the steering wheel. Ensure this is possible by depressing the clutch with the right foot.

Spend the time it takes to adjust the seat-back and tilt until the above three steps can be achieved. Avoid extremes. None of the driving movements involving arms and legs should end with the limbs being fully stretched.

The seat is the link between driver and every single reaction of the car. Its "fit" and comfort is crucial. The seat, together with the footrest and six-point harness, enables a car and driver to become one entity.

Adjust the seat precisely. Seating position is the beginning of Basic Car Control.

Visual Acuity

Vision controls comfort and comfort controls speed. Keep your eyes ***up***. Do not look at turns, use them like windows to look through. Use corners as view-finders; look through them, down straightaways, to the furthest point. Driving-visually-at the horizon increases awareness, minimizes ground rush, and provides the perspective that is crucial as speed increases.

Eyes should be focused where useable information becomes available. At high speed, all available visual information cannot be processed and superfluous information must be eliminated or minimized. Many driving actions must become automatic or pre-planned, freeing the mind to anticipate and process usable information.

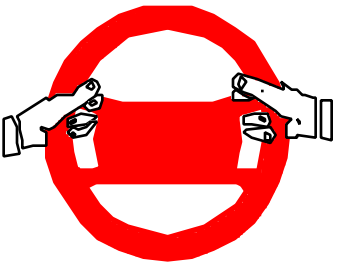
Visual imaging, anticipation and key information processing must precede real-time

visual perception and information processing.

Keeping your horizon up requires practice, and practice shapes habits. Restructuring the visual habit is one of the most difficult but profoundly skill-enhancing tasks every driver must face.

Recognizing, much less changing, any inefficient habit is difficult. Refabricating habits demands more desire than dexterity; it requires practicing good habits all the time, not just on weekends during events. *Speed* is a *by-product* of the efficiency with which techniques (good habits) are applied. Initially, speed is a detriment. It does not need to be practiced, it comes with practice.

Steering Wheel Hand Position



With the mechanical advantage of the sports car's smaller diameter steering wheel, tires can be deviated further, quicker and more smoothly than most vehicles. Regardless of steering wheel diameter, slow hands or hands out of place in a turn reduce effective turning rate. Thus, hand movement and placement on the steering wheel can be performance-limiting habits. In some cases, hand placement and movement can deteriorate so badly the intended path becomes an impossibility.

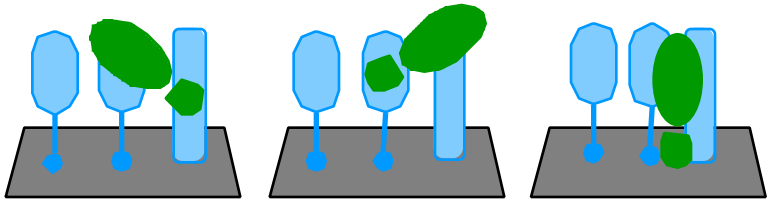
Use two hands! Visualizing a clock, your hands should be placed at 3 and 9 or 2 and 10. This hand position aids in centering a steering wheel without taking your eyes from the road, and it provides a "home base" for maximum control in all driving situations.

Do not grip the wheel too tightly! Curl your fingers around the wheel and feel it. Do not hold the wheel with the palm of your hand. Palms are far less sensitive than fingers.

Heel-and-Toe

What do you do on a straightaway before entering a turn, if you want to slow down as quickly as possible, without taking your foot off the brake to double clutch?

Heel-and-toe the pedals.



Modulate the brake with the toe of your right foot at the same time you modulate the gas pedal with the heel of your foot. *OR*... Modulate the brake with the heel of your right foot, at the same time modulate the gas pedal with the toe of your right foot. *OR*... Use the left side of your right foot on the brake, the right side on the throttle and do not use the heel for anything except a pivot point. Now that will take a passel of practice!

How do you know which one you need to learn? Know all of them because you will be driving many different cars. The techniques you will employ depends on the placement and spacing of the pedal cluster. Sometimes one way works, sometimes another is better.

Imagineering

Prior to a running, it is essential to warm up your brain as well as the car. Do not forget, the more automatic your actions are, the better!

Mentally photograph the course. Arrange the photos in a mental "slide show". Sit in the car with your eyes closed, helmet and driving gloves on and replay the course exactly as you intend to drive it. Repeat these slide show images until they become fluid. Then, run the course in mental fast forward. Turn the steering wheel, shift gears and brake at appropriate locations.

Turning your thoughts into motion provides excellent practice even in your easy chair at home long before the first track day.

Draw pictures and make notes. Start a journal. Each time you come off course, evaluate the session and place the evaluations with your notes and drawings. Most professionals keep a journal of each track and update it as part of their mental recording between sessions.

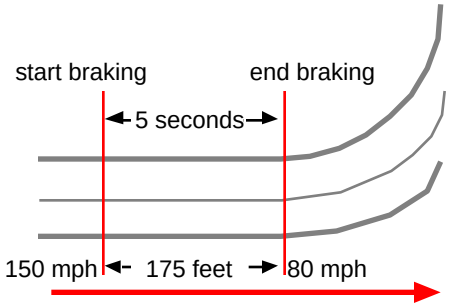
Top drivers, with the aid of their journals, have mentally rehearsed many times. That is how they make it look so easy.

Part Two: Controlling the Vehicle

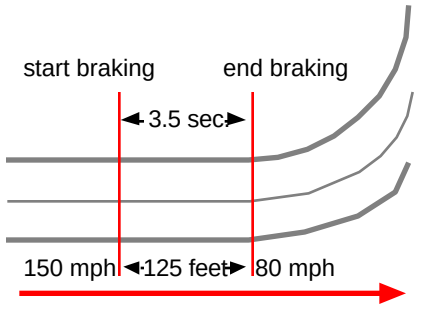
Braking

Brakes are not limited by horsepower or to one set of wheels. Braking can be accomplished at the outer edge of the vehicle's performance envelope; acceleration cannot.

You can slow a car faster than you can accelerate, therefore, improper braking technique is more costly in time management than improper acceleration technique.

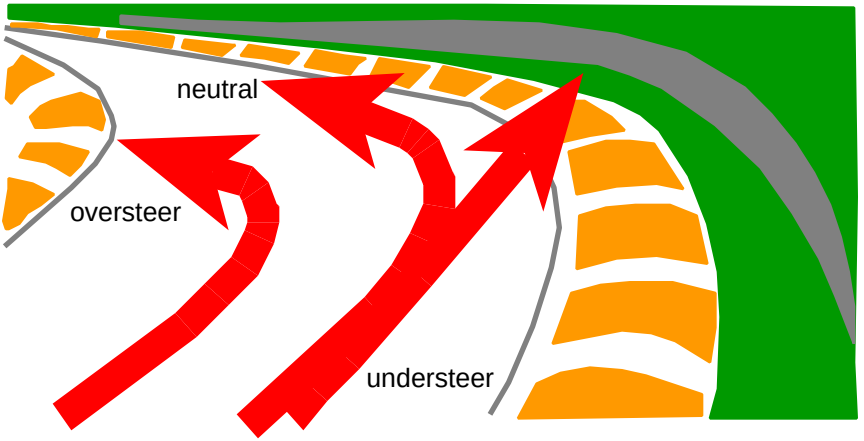


Over the same distance, brakes are capable of producing a greater change in speed than the engine. Plus, it is more difficult to achieve and sustain efficient braking than comparable acceleration. A firm, steady, but rapid and sustained maximum application of brakes is very efficient. This is called threshold breaking. Brakes are on the threshold of stopping tire rotation. When threshold braking is exceeded and brakes stop tire rotation, rapidly pumping the brake pedal (cadence braking) restores rolling friction much more efficiently than jabbing the brakes. Cadence braking is imitated by vehicles equipped with ABS Systems.



Brakes are the vehicle's most efficient performance system. If you do not believe it, try driving away from a stop in first gear with the brakes clamped on.

If you have been searching for techniques which provide big improvement, you will find more time can be trimmed over the same distance by increasing braking efficiency than by increasing acceleration efficiency.



Oversteer and Understeer

What do these terms mean when you drive into a corner?

If your car begins to understeer, the front tires are losing traction and the car is not turning into the corner as much as it should. There are three things you can do:

1. Increase the amount of steering input. Turn the steering wheel more.

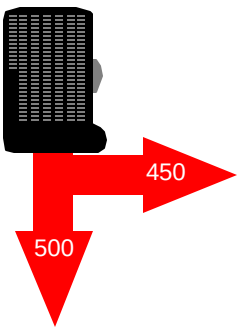
2. Decrease the amount of steering input. Unwind the steering wheel until you regain traction.

3. *Gently* reduce throttle input until the front tires regain traction.

If your car begins to oversteer, rear wheels are losing traction. The rear of the car is beginning to slide out and is causing the front of the car to turn into the corner without additional steering. If this continues, you will soon be facing traffic that was following you. There is only one course to follow:

1. Turn the steering wheel in the direction the car should travel (turn into the slide), increasing the radius of the turn and reducing the slippage at the rear wheels. This can be further assisted by maintaining throttle.

Vehicle Control



Tire response and its related "feel" through the steering wheel diminishes as tire traction limits are approached. Properly timed and executed turn entries must take into account the speed necessary to produce desired response from the tires as forward momentum gives way to cornering forces.

As speed increases, tires work harder and harder until they approach a saturation point. There is a point where

the front tires reach their limit first (understeer) forcing you to no longer maintain an intended path. At this point additional steering efforts to "make" the planned change of direction hopelessly overload the tires.

Cars react entirely from driver input. Fear brings panic input, and panic input is always wrong. Cars demand smoothness. Smoothness comes from confidence. The car cannot read your mind, only your touch.

How a Driver Affects Balance

A steering wheel changes direction of rotation of the tires. Vehicles on pneumatic tires are unique in that forces generated through and limited by the friction of the tires produce guiding control.

Car balance is achieved and maintained only when a car is driven smoothly. This means a firm, rapid squeeze on the pedals, and no sudden jumping on the brakes or off the gas, sawing the steering wheel or jerky, sudden movements. Down shifting, turning into and moving through a corner should be seamless, a fluid motion.

Skilled drivers can make slight steering corrections and still remain smooth. If you have fouled-up in your approach to a corner, it is far better to go through off-line and smoothly than to try and make jerky, last second corrections.

Smoothness is the glue that holds your car to the road.

Cornering - the Essence of Advanced Driving

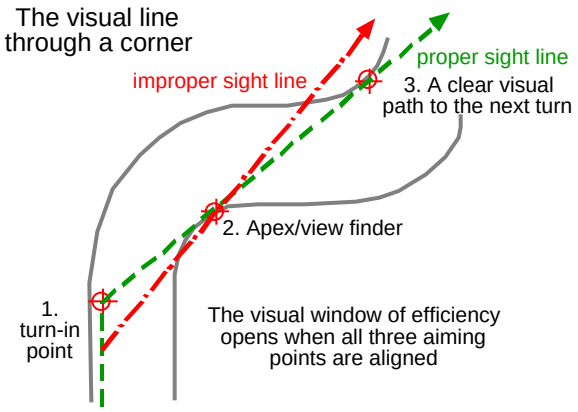
Every turn has a visual window of efficiency. This efficiency window is composed of three aiming points which define the line through the turn:

1. The *turn-in point*, the point when straight line braking is exchanged for turning.

2. The *Apex,* the point at which the vehicle is nearest to the inside of the corner's radius.

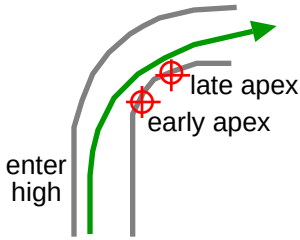
3. A *clear, on-course, visual line* to the next turn.

Think of the apex as the turn's visual viewfinder. Like a rifle sight, look through it. Many drivers try to make the car go faster in a corner by merely pushing harder on the accelerator or turning tighter. The professional driver separates himself from the amateur with the ABILITY and KNOWLEDGE to know when to LIFT his foot and STOP turning.



Rules of Cornering

1. Speed. *Always enter the turn just below maximum.* At maximum or above, the vehicle will understeer, (be resistant to turning), and the chosen path through the turn will be compromised. Less than maximum on entering a turn provides a traction reserve so acceleration, (a fundamental of balance), can be gradually increased throughout the turn.



Speed: enter at less than maximum

The simple action of turning slows a vehicle. In order to maintain a constant speed, once a turn is established, it is necessary to gradually increase the throttle. If you find it necessary to reduce the throttle after establishing a turn, the entry speed and/or position was misjudged.

2. Position. *Enter from the high side*, the side opposite the apex. Unless there is a very valid reason for doing otherwise, *always take a late apex*. A high entry and late apex provide the necessary control to position the vehicle in the most advantageous approach location for the next turn.
Ideally, braking is completed in a straight line as you reach the turn-in.

Turning into the corner from the proper position at the proper speed establishes the ideal line. This takes lots of practice.

Select some judgment points (braking markers). Choose permanently fixed markers on the side of the road: such as off-shade clumps of grass, trees, signs, curb markings, etc. Do not pick movable objects. Braking markers are important references and it is very easy to let your eyes become fixed on them. Do not! Use your peripheral vision as you get closer. *Keep looking ahead*! Use your full visual scan.

Corner approaches are usually made very close to the outside edge of the track. Try to stay approximately one foot away from the edge entering a corner.

Be smooth!

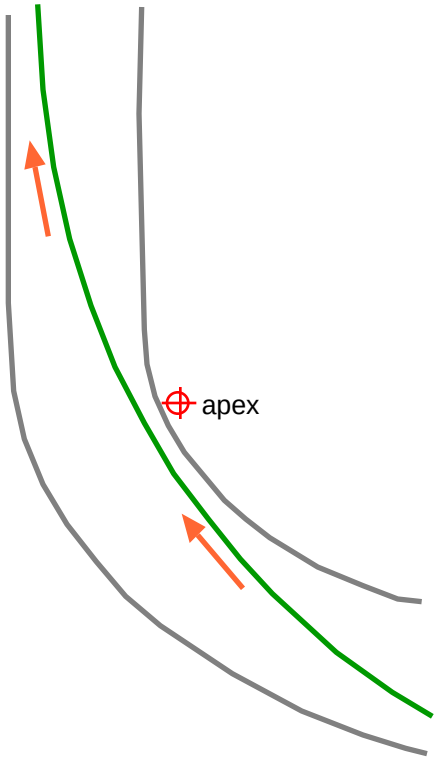
Remember, braking should be finished before you turn-in

Types of Corners

Long Curves (Sweepers)

When negotiating a long curve remember:

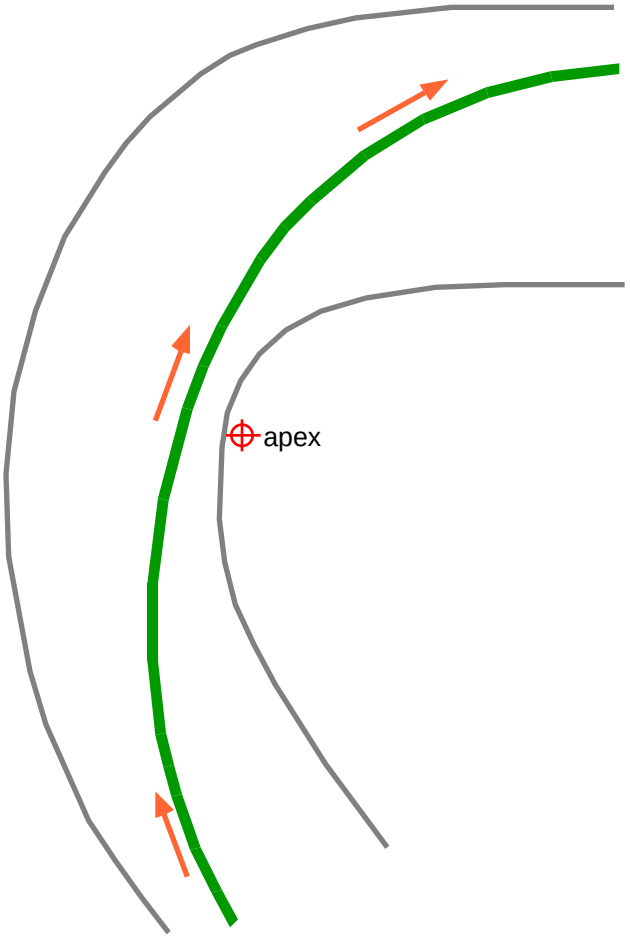
- They can usually be driven very quickly.
- You should use as much of the road as possible.
- It is essential to look ahead through the corner.



Increasing Radius

The increasing radius curve:

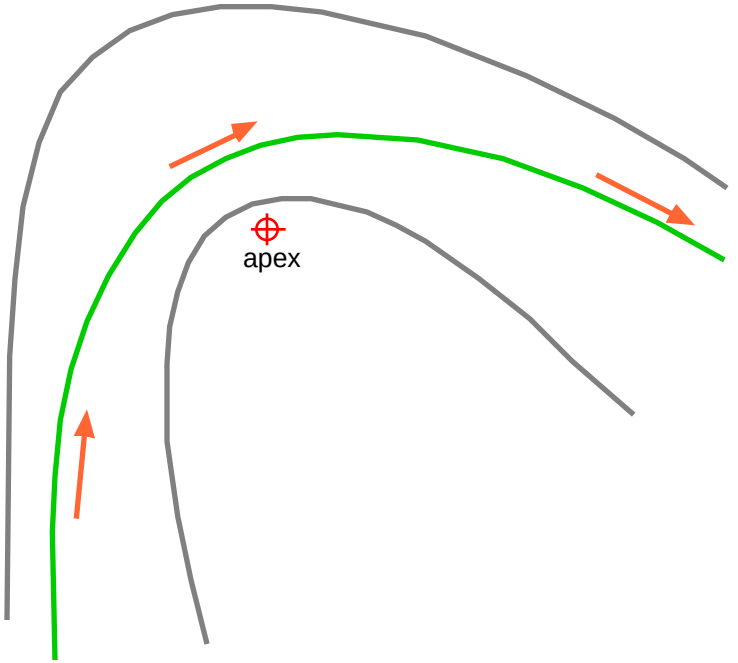
- Widens at the exit.
- Has an apex which appears early.
- Produces a high rate of acceleration at the exit.



Decreasing Radius

To negotiate a decreasing radius curve:

- Be careful.
- This is a very deceptive turn because it keeps getting tighter.
- It has a *very late* apex (with an early apex you would run out of road at the exit).
- Be patient and stay wide at the entrance, even though it may not "look" or "feel" right.
- Stay wide if in doubt, until you actually see through the turn, then turn in.



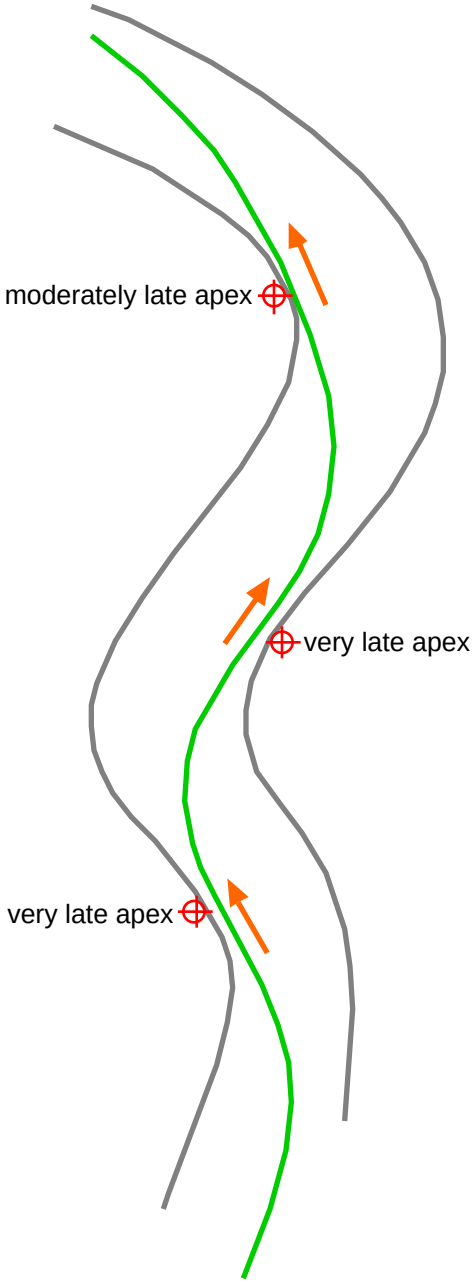
Compound Curves

- Are commonly called "The S's".

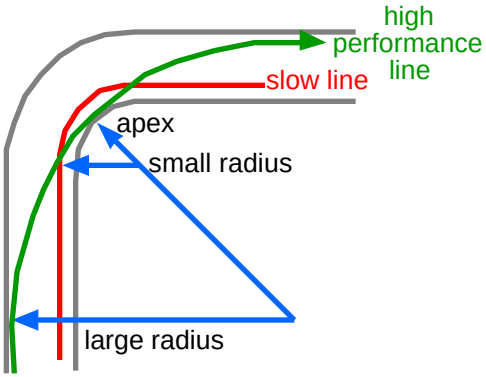
- Have two or more turns which cannot be driven as one curve.

- Dictates the last turn as the most important; all the others have their lines modified to accommodate the best entry into the next turn in the series.

- Require you to keep in mind weight transfer from side to side.



Negotiating the Corner



Cornering speeds depend on the camber and *radius* of the curve. The smaller the radius, the lower the sustainable speed.

The principle of cornering is to strive for the maximum possible radius within the allowable traveled distance of a corner.

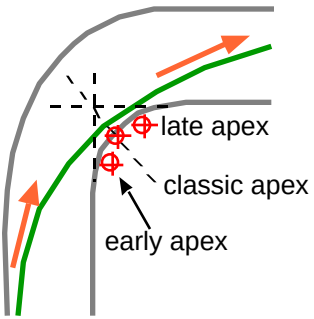
The Apex

The apex is the point where the largest possible radius touches the inside of the turn. The geometric bisection of the turn is referred to as a classic apex.

Late Apex

A point placed later than the geometric center in order to produce a faster exit speed also produces a higher final speed at the end of the straight.

Late apexes are used most effectively when a long straight follows the curve. The line producing a later apex demands a later braking point and sharper turn into the corner, slightly reducing cornering speed. Sacrificing a small amount of entry speed and cornering speed for the best exit position and maximum velocity on the next straight is an acceptable trade-off.



Early Apex

A point placed before the geometrical center of the turn is the driver's natural tendency. However, this frequently results in running out of road before reaching the exit of the turn.

The Apex and the Ideal Line

Advanced drivers are not concerned with any one corner on the road, but rather with linking all corners in a smooth, seamless fashion. Consideration must be given not only to the corners, but also to positioning on the straights leading into or out of the corners.

Be mindful of the fact that car brakes are substantially more powerful than acceleration capability. The best exit speed from a corner is more important than

entrance speed. Hence, the rule is: *Always enter a turn at less than maximum*.

The ideal line is one which passes through a point on the inside of the turn that allows:

1. the earliest entry into the turn,
2. the shortest deviation from a straight line
3. the earliest opportunity to fully open the throttle and keep it open until the next braking point.

This ideal line defines an apex point referred to as *the ideal apex*.

The point *you* place the car closest to the inside of the turn becomes an apex. It might not be the most efficient and it may not have been the apex you really planned, nonetheless it becomes the apex.

The key to effective apex placement requires understanding *you* (the driver) *have the ability to place the apex wherever it is most beneficial*. This becomes the truly practical application of your ideal line, one that allows the apex point to define the line, as well as the line defining the point. Remember, apexes are moving targets which can change from lap to lap, making them challenging and exacting.

Transitions

Transitions are areas where braking and turning or accelerating and turning occur simultaneously. They are zones of shared traction.

Precise speed at the turn-in point is crucial.

Once the steering wheel is turned, total available traction must be shared by acceleration and cornering forces. If 100 percent adhesion is used in any one area, whether braking, acceleration or directional control, there is none left for the other two.

Dancing on the edge of adhesion while sharing traction forces must be a well-choreographed ballet.

Rules of Transition

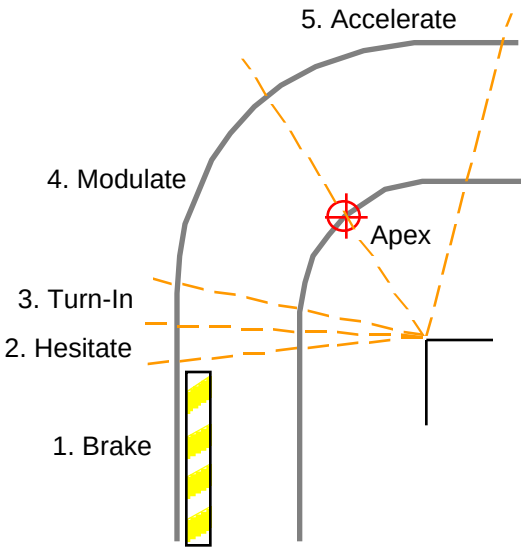
1. *Brake* as if a feather placed on your toe would cause the brakes to lock up, but do not lock them up. Wheels must keep rolling in order to turn-in.

2. *Hesitate* prior to turning into the corner. *Pause,* but do not decelerate, do not accelerate. Allow the suspension of the car to stabilize, or to "take a set." This establishes car balance for the turn.

3. *Turn-in* when car balance is established.

4. *Modulate* steadily, adding throttle which assists in maintaining balance. By the time your shoulder is opposite the apex, the throttle should be fully open.

5. *Accelerate* at the apex where turn radius increases. Use full throttle to the next brake point. If it is necessary to back out of the throttle in order to maintain the line, apex placement is incorrect.



Part Three: Putting It All Together

Driving a car is a dynamic exercise which is not limited to the physics controlling simple motions. Yes, you can brake, accelerate and turn. You can also brake and turn at the same time or accelerate and turn at the same time. More importantly, you can brake a lot and turn a little or brake a little and turn a lot.

The entire road-holding capability decreases as speed increases. As it nears its limits, the car becomes more sensitive to smoothness. The physics of motion are disadvantageously loading the suspension.

If tire adhesion is the glue that holds the car to the road, smoothness is its applicator.

Do Not Be Intimidated

The logic of polished performance driving is easily understood. We want to get from point "A" to point "B" quicker.

I always like to run an event like Bret Maverick plays poker; get all the odds in your favor before the game starts. To do so takes advanced preparation.

To put this whole learning experience on a level that can be dealt with, just whittle it down a bit and set some goals.

Goal 1: Visualize the Ideal Line

Go from "A" to "B" correctly.

Do your personal best without mistakes. Do not worry about anyone else or how fast they do it, yet.

Compete with yourself. No pressure, just do better than you did last time. Keep notes to reduce repetitious mistakes. Do not strive for speed. Strive for accuracy. Speed will come as a direct result. It is not even necessary to think fast, that will happen as the proper pieces fall into place. Speed is a by-product of accuracy. Even a thinking man's game has leg work.

Now . . . Out to the course.

Walk the course if at all possible and visualize the ideal line.

As you are figuring out the line, break the course into sections. Give extra consideration to course sections which seem most difficult for you. Deal with them individually. Dissect them. Actually look at them from all angles and figure out why they are perplexing to you. It is all a matter of visual perspective, when you find the right one it is no longer difficult.

Look at these segments logically and picture yourself driving through them.

Mentally play with different ways to "see" your way through. These are the "lines," and there are many different lines through a turn. Choose one which allows the greatest forward speed without going off the road yet points you toward the next turn.

Begin by using the chosen lines to mentally connect individual turns. As course segments are visualized, certain references will stand out in your mind. These are "keys," memorize them. These keys make the course memorization much easier. By memorizing these, a course can be remembered quickly, simply and efficiently. It also can be recalled mentally for instant replay, even months later. This will prove to be a very resourceful skill. It is a bit like ol' Bret Maverick remembering which cards have been played out of the deck and *HOW* they were played.

Each course will have an overall flow pattern, or a selection of lines forming the most efficient course progression. As you walk the course, carry a piece of paper and a pencil to sketch the course and draw the different segments. Sketch in your lines through the segments. Visualize!

With the walk-through completed, reconnect the segments to form a complete course. Some modification of individual lines which have been sketched is very likely. Any alteration will be dictated

by the overall flow pattern of the course when connecting one segment to the next. For now it does not matter whether the flow pattern you have chosen is the most efficient. Just get through the course according to the sketch. When the time comes to put theory into practice, follow your plan just as you visualized it, and do not make changes on the track.

So much for theory . . . let's go practice.

Goal 2: Execute Your Plan

Pre-plan your moves.

Changing your plan on track will lead to confusion. Confusion on track costs more time than a simple error in line. If changes are necessary, and they will be, make them between track sessions. Visualize how they affect the course on paper, then try them in the car. Do not worry about mistakes. Mistakes are part of the learning process. Execute your plan. If it does not work, replan between sessions, and repeat this process as a learning tool. Keep a record of the changes made, whether they worked or not, and what might have worked better. Remember, this is a mental gymnastic exercise that is graded by physical performance. Save all notes and sketches for a journal. You will soon see your driving skill and knowledge grow quickly.

Approach all sessions with 100 percent concentration from the time the engine is started until it is switched off. Just prior to the start, mentally replay the course in your head. Now is the time to know your plan.

Begin *NOW* to train your eyes. Knowing beyond a shadow of a doubt where to

go will not help you if physically seeing where to go is limited. Visual efficiency is greatly increased with the implementation of two learned skills: looking where the usable information is available and scanning.

Goal 3: Keep Your Eyes Up

Teach yourself to look ahead.

The further ahead your vision is focused the greater the perspective. Objects do not pop into view immediately or unexpectedly. Setting you up for the ground rush syndrome. Its symptoms include:

1. the immediate realization and sensation of speed;
2. Objects outside the car move into view with little or no visual warning
3. and the driver is forced to constantly react.

Planning ahead is unthinkable. The entire rhythmic process of driving is forced out of step. The driver is no longer "at one" with the vehicle, nor in total control of it. He is the owner of a 40 mile-an-hour brain traveling considerably faster.
The ground rush syndrome lowers personal comfort levels and causes a driver to prematurely reduce throttle pressure. Generally, this throttle reduction occurs without the driver's conscious knowledge. When a driver is so busy attempting to catch up mentally, the car must be slowed to close the visual gap and realign the mental process.

Looking ahead to objects on the horizon will maximize the extent of the visual range and greatly reduce the chance of ground rush syndrome. Practice, even in everyday driving, by looking where the roadway meets the sky or a hill. Use this horizon reference as the outer visual limit and the cowl of the car as the minimum visual limit; become aware of everything between the two. Although you may think you do this, you do not! At least not efficiently enough. Do not believe it is easy. It is not. This skill requires patience to perfect and constant practice to keep. A maximum visual horizon provides a perspective of overall situations. Like walking the course, maintaining vision at the point of emerging information creates perspective.

Goal 4: Overcome the Temptation to Fixate

Develop a visual scan. While in motion, studies show the human eye to be inefficient in perception, particularly detail. As the eye moves to scan an area, break down the scan pattern into mental snapshots. In a normal 120 degree scan, break the arc down into six or eight separate pictures or scan sections.

Wherever you are, take a quick visual scan of the area in front of you. Start at the horizon on your left and scan across it to the horizon on your far right. Do not concern yourself with breaking the scan down, just scan the area in front of you left to right as you would normally. Use the horizon as an outward limit, but concentrate on seeing everything between you and it.
Close your eyes and take a mental inventory of what was perceived.
Repeat the scan. This time, break the visualization into six or eight mental snap-

shots as your eyes move.

Compare the first mental picture to the second. It is amazing and fun to perceive detail that was not noticed before. Try it again, this time behind the wheel of the car at speed.

The ability to look further ahead and to scan are performance limiters. Their direct impact on perception controls driver perspective and can either increase or reduce the comfort factor. The lower the factor, the slower the driver. Higher factors produce quicker times and control the "*pucker factor*".

E. Paul's First Rule: Driver efficiency decreases by the square of the pucker factor.

Today's cars are engineered to be forgiving of a driver's small mistakes, particularly in turns. However, no car can forgive everything. Most small mistakes are commonplace and alone would not cause trouble. But collectively, innocent factors in given sequences or combinations, can become treacherous.

Just remember the word **P A V E D**

Plan ahead to improve a few things
Avoid trying to cope with too many factors
Visualize; keep things in perspective
Execute your predetermined plan
Drive within your own personal comfort factor

Racing Flags

GREEN: Start Indicates the start of a practice or qualifying session, or the start or restart of a race.

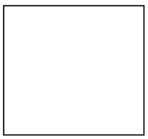
YELLOW: Caution, slow down, hold position, NO passing. An unsafe track condition exists. **Waving YELLOW:** Immediate Danger, slow down, no passing. **Double Waving YELLOW:** Indicates the entire race course is Yellow.

RED: Stop Racing, the course is blocked. Pull to the side of the race course and come to a complete stop insight of the next corner station.

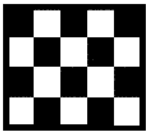
YELLOW WITH TWO VERTICAL RED SLASHES: Tells of a slippery track surface. Exercise caution.

BLUE WITH YELLOW DIAGONAL STRIPE: A faster car is overtaking be prepared to expedite the overtaking traffic.

BLACK: Pull into the pit. The car being signaled must go immediately to the Black Flag Area in the pit for consultation.



WHITE: Advises there is a slow moving emergency vehicle on course.



CHECKERED: Notifies the race or practice session is finished. Quit racing and cool your car down; enter the pit at the next opportunity.

E. Paul Dickinson
High Performance
Driving Coach

Known to his clients and colleagues by "E. Paul," he has applied the latest knowledge in the behavioral sciences and high performance driving instruction to practical driving situations for more than 25 years. E. Paul was owner/chief instructor, for 10 years, of a 40 acre law enforcement training center providing instruction Approved by SCCA. He has coached literally hundreds of racing drivers, law enforcement officers and corporate students from across the United States and numerous foreign countries. Many students have gone on to win National Championships or become Professional Law Enforcement Instructors themselves. His commitment to excellence and high standards has continued in his consulting practice with corporate organizations, law enforcement agencies and in motorsports.

E. Paul is a federal and multi-state certified Law Enforcement Driving Instructor, Six Time SCCA National Solo Champion and past member of Porsche's Endurance Racing Team. He has held FIA, IMSA and SCCA Professional Competition Licenses and been a sworn law enforcement officer. Currently, E. Paul maintains several Historic Racing Licenses.

A performance driving consultant's jpb is not to personally solve problems. Instead, it is to work with those who are stimulated to grow:accelerating driver excellence and developing within each student an ability to formulate solutions at high speed.

Are You Looking for a Roadmap to Ten 10ths?

There is more to driving than Fast, for those lusting to distill a 100 percent from themselves and their cars Personal Coaching will quicken their pulse rate and their lap times.

Consider A Personal Trainer...

- New perspectives about speed and control.
- On-track exercises selected to meet your specific improvement goals.
- Customized "just-in-time" curriculum integrating theory and on-board learning in an exciting personal journey into the world of unrestricted speed.

For more information on E. Paul and E. Paul Motorsports:

E. Paul, Inc.
P.O. Box 14666
Pittsburgh, PA 15234

call : 412.341.8011
fax : 412.341.8644
email: epaul@nb.net
website:www.epaul.com