The Ace Factor

A Guide to what you need to know about Vintage Racing

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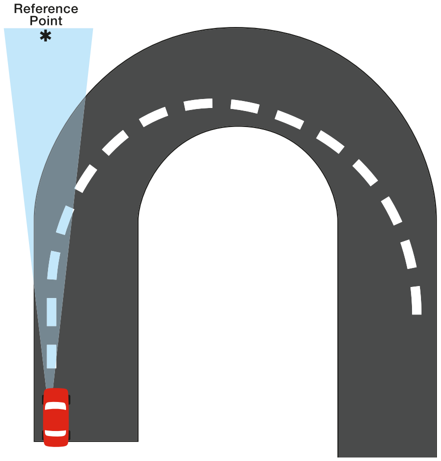
MOTORSPORTS COUNCIL

The following is an excerpt from The ACE Factor.

Eye Technique



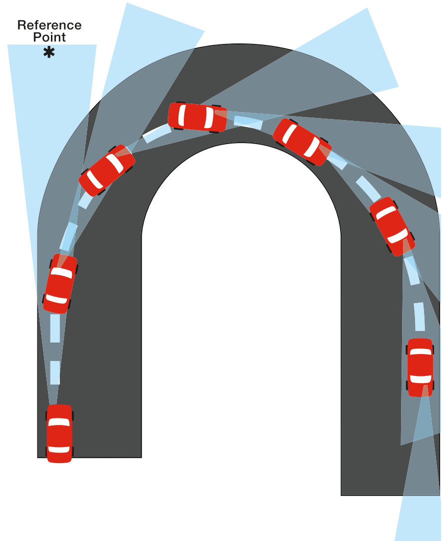
Every action taken behind the wheel is a direct result of what you see and how soon you see it. Increasing field-of-vision dramatically improves performance.

Keep your eyes up. Look down straight-a-ways, to the furthest point. By increasing the amount of visual information received, potentially dangerous situations can be recognized before they turn critical.

If you do not receive correct visual information in adequate time, it is impossible to make correct decisions. Eyes should be focused where usable information becomes available. Pick a distant reference area or point on the horizon that you are traveling towards. Use it as a course heading, much the same as if you were piloting a boat.

Where You Look Is Where You Go

When you pick out distant reference points to use as course headings, make sure they are in the direction you want to go. When you use any stationary point, you unconsciously steer toward it. Simply stated: **A car goes where the driver looks**. This is because the natural instinct is to turn the steering wheel in the direction in which you are looking.



Keep your sight picture on the horizon, the point of emerging information. Lead the car with your eyes—look where you want to go. This requires practice...A lot!

Restructuring this visual habit from a street ability to a track skill is one of the most difficult, but profoundly performance-enhancing, tasks every driver must face.

Safely increased track speed is a BY-PRODUCT of efficient skills (good habits). Recognizing, much less changing, any inefficient habit is difficult. Initially, going fast is a detriment. Don't practice Speed. Speed comes with practice. Re-fabricating habits demands more desire than dexterity; and it requires practicing good habits all the time, not just on weekends during events.

Imagineering

Prior to a running, it is essential to warm up your brain as well as the car. The more automatic your actions are, the better!

Mentally photograph the course. Arrange the photos in a mental "slide show". Sit in the car and close your eyes with your helmet, belts and driving gloves on. 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.

Start a journal. Each time you come off course, annotate a track map. Evaluate each session and place the evaluations with your notes and track map in the journal. Most professionals keep a journal and update it as part of their mental recording between sessions and after race weekends.

Top drivers, with the aid of their journals, mentally rehearse many times prior to race weekends. That is how they make it look so easy.

Braking

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

Braking is not limited by horsepower or to one set of wheels. It 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. Over the same distance, brakes are capable of producing a greater change in speed than the engine.

Improper braking technique is more costly in time management than improper acceleration technique. A firm, steady, but rapid and sustained maximum application of brakes is very efficient. This is called threshold braking. Brakes are on the threshold of stopping tire rotation.

The amount of adhesion to the tires is forever changing because road conditions and surfaces vary tremendously. This is why the brake pedal pressure needed to achieve threshold braking constantly changes and is related directly to the tires' adhesion on the road surface.

When threshold braking is exceeded and brakes stop tire rotation, rapidly pumping the brake pedal (cadence braking) restores control much more efficiently than jabbing the brakes. Cadence braking is imitated by ABS systems.

Braking is second only to eye technique in importance. Proper braking technique is highly dependent on visual depth-of-field. Looking too closely at the front of the car skews perspective. By the time the driver sees the situation, panic and reflex dictate the response—often full force on the brake pedal.

If you have been searching for techniques for big improvements, you will find more time can be trimmed, over the same distance, by increasing braking skills and hardware than by increasing acceleration efficiency or horsepower.

Don't Brake Backwards

Street driving reinforces many habits that we bring with us to the track, not all of them good. For instance, gently slowing to a stop can be counterproductive on the race track.

On the street, many drivers see brake lights or a traffic signal and apply brake pedal pressure variably until reaching a desired spot. Many racing drivers continue this street habit: initially braking lightly, then pressing progressively harder and harder toward the end of the braking zone.

This "backwards braking" pitches the car forward and unloads the rear tires at a crucial point prior to turn-in. It is not smooth and robs the rear tires of adhesion (grip), contributing to spins once the car is turned-in.

Braking backwards requires longer braking zones and most always leads to increased corner entry times as well as a poorly balanced car. Clearly, this method leads to increased lap times.

To decrease lap times, a driver must use a firm, steady, but rapid and sustained maximum application of the brake. The goal is to maintain a constant rate of deceleration throughout the braking zone. Efficient, smooth braking requires high initial pedal pressure, modulated only to keep the tires at that threshold just before lock-up. This threshold braking maintains the tires at the limit of grip.

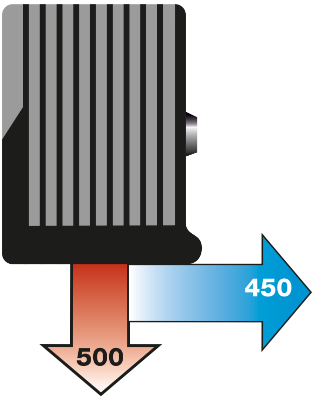
It also shortens the braking zone, decreases corner entry time, provides better car balance and facilitates seamless turn-ins. This more efficient use of brakes also spreads heat dissipation in the rotors over the full braking zone so rotors don't experience extreme temperature spikes.

Besides extending rotor and pad life, it helps explain why experienced drivers go faster with smaller brakes (they don't give up as much momentum entering turns and they create a much more stable vehicle platform) while less experienced drivers warp rotors, look for additional brake cooling and say: "Well…it feels fast!"

Driving fast is an exercise in energy management. It takes TIME to produce speed. Don't increase lap time by using the brakes unnecessarily. When braking, BRAKE! Don't sneak up on a corner.

Vehicle Control

The car cannot read your mind, only your touch.



Tire response and its related "feel" through the steering wheel diminish as tire traction limits are approached. As speed increases, tires work harder and harder until they reach this traction limit 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.

Properly timed and executed turn entries must take into account the speed necessary to produce a desired response from the tires as forward momentum gives way to cornering forces.

Passive Vehicle Control

Passive Dynamics refers to the static disbursement of weight on the chassis that has a controlling effect on vehicle handling when the car is in motion. The engine placement in the vehicle and the wheels that are driven (drive train layout) define each vehicle's passive (static) weight disbursement.

Each tire has a contact patch. As the tire rolls, this footprint is the part of the tire tread that actually comes in contact with the road. Each contact patch is approximately the size of the palm of your hand. The normal footprint, total contact patches of all four tires, is about the size of a piece of notebook paper: 8.5 X 11inches.

A vehicle's drivetrain layout will influence everything from the individual contact patch of a tire and overall turning radius to weight distribution. Optimum static weight distribution (static balance) is commonly achieved when the overall weight of the vehicle is evenly spread between each of the four tires.

When a front engined car is parked, the front tires' ground contact patches will have a slightly larger footprint than the rear tires. A rear engine car will be the opposite, with slightly larger footprints (contact areas) in the rear tires than on the front. The smaller the footprint of the tire's contact patches, the less traction is available to the tire.

Conversely, the concept that a larger vehicle contact patch equals greater traction is only true to a point. How the tires' contact patches are controlled when a car is in motion is more complicated.

Active Vehicle Control

Active Vehicle Control (Active Dynamics) deals with the car in motion and the driver's ability to effectively manage all four tire contact patches... simultaneously.

Acceleration, Braking and Turning, are the three forces that act on a vehicle in motion. They produce different handling properties in the vehicle, independent of drivetrain layout. How a driver manages the overall weight distribution of the car, its relationship between the load on individual wheels and their ability to turn, brake or apply power is called dynamic balance, most often referred to as "balance".

Every action you take behind the steering wheel effects balance (weight changes on the car's suspension) and controls the size of each tire's individual contact patch and ability to grip a road surface.

Remember, the car's ability to grip the road is through the four tires' contact patches. Each has a surface area no bigger than the palm of a hand. Balance (maintaining maximum available grip through the tires) is largely driver controlled.

If a tire's contact patch grows too large, or too large too quickly, it becomes overloaded and looses traction (grip). Conversely, when a tire's contact patch becomes too small, or too small too quickly, it becomes underloaded and does not have enough traction (grip). Whether overloaded or underloaded, when tires loose grip on the road surface they "break loose".

How a vehicle handles as speeds and cornering forces increase depends greatly on how smoothly it is driven. Possibly, the most common and most serious mistake is starting into a turn with excessive braking combined with high speed. No matter how smoothly you turn the front wheels when the vehicle is in this state of balance, the likely outcome is that the rear end will start to break loose and slide into the opposite direction from which the steering wheel is turned. And the further out of balance the vehicle is, the quicker its rear end will rotate. When the weight distribution is totally out of balance, the rear end will rotate in a snap of the fingers.

Suspensions

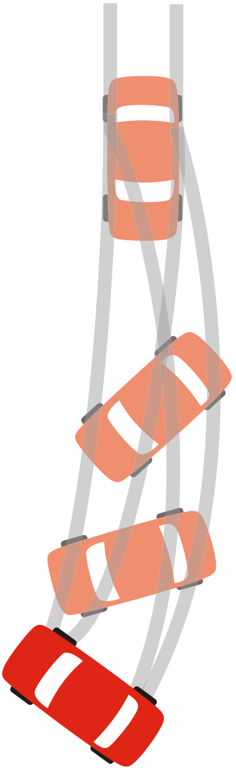
The use of stiffer shocks and springs in a suspension system has long been the prescription for improved handling. Simply put, by increasing the pressure needed to compress the springs and shocks, the "body roll", or how much the vehicle leans in a corner, is reduced. This provides a better control of the car's balance—the weight transferred onto each tire. A better distribution of the weight transferred onto each tire makes the car more controllable.

High performance suspensions provide a car with higher cornering limits (the point at which the tires lose their grip on the road surface). Because these limits are higher and not often approached in normal driving, many drivers have little knowledge or experience with what will happen when limits are approached or crossed.

Softer, or standard, suspension packages are more forgiving because they allow the body to roll or lean more in a corner. The driver, sensing the increased body roll as discomfort, is provided a clear warning that the limit of adhesion is fast approaching. He then has the opportunity to adjust his speed and steering before reaching the limit of control.

Normal suspension systems do not require that you know or think about where their limits are. Driving skills that work on the street lure drivers of high performance cars into a false sense of security. When these higher cornering limits are crossed after little or no warning, lightning-quick and precise driving reaction is necessary to retain control.

Anatomy Of A Slide



Street driving rarely exceeds six-tenths of a vehicle's performance and road holding capability. Above sixth-tenths, your pulse rate and adrenaline begin to synchronize.

Steering wheel response is direct at less than sixth-tenths of maximum road holding capability. A quarter of a turn produces a linear response from the tires. Above sixth-tenths, as speed increases, steering response grows more numb. At nine-tenth's, increasing the steering input by 20% will often produce only a 5% return in response.

Once two or more tires lose their grip on the road surface, the vehicle is sliding. What happens next depends on how well you deal with it.

Consider the driving environment of a racing car where things happen really quickly…the car begins to slide...the driver works out a solution...then he reacts. By the time all of this is complete and the reaction message reaches the muscles, quite a bit of time has elapsed in terms of rectifying what is happening in real-time vehicle dynamics.

The driver inputs the correction. Maybe it is a little too much. Maybe the input is a little too slow. No matter, the driver thinks he is reacting to something that is happening right now. But, in terms of vehicle dynamics, it actually happened a long time ago.

In what seems to the driver as an instant, the car is going the other way. The driver reacts again, but he is in real trouble now! Believing he is keeping up with the car (which is functioning in real-time), the driver, (functioning in reaction-time), is actually lagging far behind the car.

Many drivers are convinced that what has happened is in real-time,when it has not. Driver's actions are slowed through a filter called reaction-time. It is this out-of-phase lag between real-time vehicle dynamics and a progressive cascade of driver inputs in reaction-time that lead to, and prolong, slides.

So what's a driver to do? Simply put: Anticipate! Anticipation is the key to capturing and recognizing the elusive secrets of safely going faster and getting there first.