PERFECT CONTROL

A Driver's
STEP-BY-STEP GUIDE
to Advanced
CAR CONTROL
Through the
PHYSICS OF RACING

THE SCIENCE OF SPEED SERIES

PARADIGM SHIFT
DRIVER DEVELOPMENT
PERFECT
CONTROL
PERFECT CONTROL
A Driver’s
STEP-BY-STEP GUIDE
to Advanced
CAR CONTROL
Through the
PHYSICS OF RACING

The Science of Speed Series
created by PARADIGM SHIFT DRIVER DEVELOPMENT
written by ADAM BROUILLARD

www.paradigmshiftracing.com
# CONTENTS

## PART 1: CAR CONTROL CUES
- **Auditory Cues** (using tires noises & engine rpm cues)  
- **Steering Wheel Cues** (finding minimum and maximum grip)  
- **How G-Force & Visual Cues Offer Precision Control**  
- **Rotation Explained** (finding the edge of under & oversteer)  
- **The Universal Cue** (optimizing overall vehicle movement)

## PART 2: DRIVER INPUTS
- **Beyond Smooth** (improving your reactive car control)  
- **Tire Forces Simplified** (visualizing steering, throttle, & brakes)

## PART 3: CORNER ENTRY CONTROL
- **How the Greats Enter a Corner** & the skills needed to do it  
- Using basic & advanced braking to control balance  
- When, why, and how to transition to acceleration  
- Driver predictions & how to fix a thousand mistakes per lap

## PART 4: CORNER EXIT CONTROL
- Maximizing grip & minimizing drag when **understeering**  
- How **front-wheel drive** teaches corner exit optimization  
- Trading steering for throttle when **oversteering**
“It ain’t what you don’t know that gets you into trouble. It’s what you know for sure that just ain’t so.”
- Mark Twain
THE LIMITS OF CONTROL

When a novice first tries high-performance driving, they will often drive the same way on a racetrack that they do in every-day driving, only faster. This causes all kinds of issues when they get to the limit, because the car control cues and driver inputs they are used to completely change. This can be a problem, because if your goal is ultimate speed, the limit is where you need to be.

Let’s imagine you need to pull into a parking spot at your local store. As you drive down the row, you eye your spot and then maneuver your car to the far side so you can get a wider entry. As you approach, you begin turning the wheel and maybe using a little brakes or throttle to change your speed, all the while focusing on the spot and predicting the path you need to take to arrive there correctly. You may make small alterations in your steering or other driver inputs to keep you on the ideal path into your spot. A key point here is that you most likely aren’t even thinking about the steering, throttle, or brakes. All your attention is on the parking spot and the path you need to take to get there. The car control needed is basically automatic.

But what would the average driver do if turning the steering wheel sometimes made the car steer more and sometimes didn’t? What if the car suddenly starting turning faster even if you didn’t turn the steering wheel more? What if the brakes sometimes slowed you down and sometimes didn’t, or the throttle seemed to sometimes just make you spin in place? Basically, everything the driver thought they knew about how the car should react seemed to change randomly. They would probably start walking to the store.

Before you can fully utilize Line Theory rules, you must get to an almost automatic level of car control.
But these are exactly the types of responses a racing driver will have to learn to contend with and many become so overwhelmed that the majority of their attention shifts to controlling the car and not on where they need to go. Their car control is no longer automatic like that average driver in the parking lot.

Introduced in our book *The Perfect Corner*, Line Theory is the term we use for the physics-based set of rules a driver can use to optimize their line. While drivers of any skill level can begin to apply Line Theory rules, to fully exploit them you must reach an almost automatic level of car control. To achieve this, you will need to first learn the correct car control cues and driver inputs needed for driving at the limit.

Car control, in essence, is about managing inputs and outputs. The outputs are your controls over the vehicle. Primarily brakes, throttle, and steering. The inputs would be all the information you are getting from the car and your surroundings. Primarily visual, auditory, and tactile. We call these inputs cues. How to optimally use these driver inputs and cues together is what this book is all about.
A TIGHTROPE ACT

Can you walk a tightrope? The vast majority of people would probably answer no. We know it is possible, because we have all seen it done, but what if you lived in a world where no one had ever done it and someone asked you to try. You would probably think it impossible and a quick try would reaffirm that thought.

So how does this relate to motor racing? While a tightrope is basically pass/fail, as you either fall off or stay on, driving a car is only as hard as a driver makes it. But to the average viewer, sometimes the difference is almost imperceptible. Watch a pretty fast local driver and to the untrained eye, they look like they are doing virtually the same thing as a world-class driver. Even an average racer in a relatively easy-to-drive car could probably get within a second or two of a world-class driver given specific instructions and a few weeks of practice. Only the stopwatch tells the ultimate difference, and the average racer most likely doesn’t even know why they are slower. They might just chalk it up to having less talent or think maybe the world-class driver has figured out some sort of better line.

In reality though, the world-class driver is doing something just as hard as what a tightrope walker does and it takes more than a few weeks to learn this. To an average racer, what the world-class driver is doing would feel almost impossible. Just like a tightrope walker, they make a finally tuned balancing act at the limit of control look easy.
What this average racer doesn’t realize is that they have essentially been walking around on a 6-inch wide board as they drive. They might every once in a while step up on the tightrope and fall off and then remind themselves to stay on the board, but unfortunately, walking around on a board will teach you very little about tightrope walking.

The first step to reaching a world-class level of car control is to realize you’ll need to step onto that tightrope before you can start learning how to balance on it. This book will give you the tools needed to do that, but understand this is hard, very hard. It will take years to master. There is a reason most world-class drivers started as children. Pushing yourself to where you need to be might feel impossible at first, just like tightrope walking. But with practice, the impossible will become hard, and then manageable, and then eventually, second nature.

Is this car at the limit and oversteering or understeering?

To find out, a driver must test - change a driver input and check the car’s response.
THE LIMIT DEFINED

So what is the limit? Ask 10 drivers and you might get 10 different answers. We define the limit as when no change in driver input can cause an increase in force. This sounds a little technical, but a simple example would be a driver traveling at a constant speed and then slowly tightening the steering. There would be a certain point where turning the steering wheel more would not make the car turn any tighter. The tires have reached their limit. In this example, it would be the front tires that reached their limit and many drivers understand this is called understeer. If the rear tires are what is limiting how much a car can turn, then you have oversteer.

The key takeaway here is that anytime you are at the limit, you will either be understeering or oversteering. This also means that for ultimate speed, you will always either be understeering and/or oversteering the entire way through a corner. While theoretically it’s ideal to use all four tires equally, it’s not technically possible to be perfectly neutral and keep both front and rear tires at the limit at the same time. This would be a transient state at best, and as you’ll see, it’s actually impossible to know if you truly are at the limit of both at the same time. If you ever think you have achieved perfect neutral balance, it just means you haven’t developed the sensitivity yet to detect whether you are actually understeering or oversteering.

For ultimate speed, you will always either be understeering and/or oversteering the entire way through a corner.

End of Sample
This shortcut as well as every other shortcut we’ve mentioned is simply a reflection of properly following the Universal Cue. They are just clues that coincide with keeping your forces maximized and heading in the correct direction. They give you breadcrumbs as you improve your skills and sensitivity to the primary cue. Eventually though, they won’t be necessary. Once you get to the skill level where the car is the astronaut and the tires are your fire extinguisher, everything else will fall into place. Just maximize and aim your forces correctly. Whatever helps you do that the best is always the correct answer because you will just be following the basic physics at work.

Our goal is not to just have you memorize Line Theory rules or try out different car control techniques to see what works for you. We want you to truly understand why you shouldn’t focus on imprecise cues like steering wheel forces or tire noises. We want you to understand why you shouldn’t simply try to copy faster drivers or memorize a preplanned set of motions for each corner. Losing is never fun, but losing and not knowing why is worse. We want you to understand why you are slow (or fast!) and how focusing on precise cues like the Universal Cue is the only way to know the right answer, the perfect answer. Naturally gifted drivers are those who drive by these precise cues, these perfect cues, intuitively, often without really understanding them or being able to explain exactly what they are doing. That’s why we have spent so much time explaining it for them, because while perfect control may not be intuitive for everyone, it can definitely be learned by just about anyone.
FIND THE LIMITS OF your CONTROL

Do you understand the true meaning of driving at the limit?

Learn how to identify and prioritize the different visual, auditory, and tactile car control cues, plus the optimal driver inputs needed to extract 100% from practically any vehicle.

We will also look in-depth at the Universal Cue. The driving cue that directly represents the physics of racing and provides the final layer of car control precision. Learn how world-class drivers use it to self-evaluate and perfect their on-track performance.

Please visit us at www.paradigmshiftracing.com

©2016 PARADIGM SHIFT MOTORSPORT BOOKS

$21.95