# Trackside Classroom

***Understeer and Oversteer***

## *Disclaimer*

*The techniques shown here have been compiled from experienced sources believed to be reliable and to represent the best current opinions on driving on track. But they are advisory only. Driving at speed at NJMP Lightning, or any other track, requires skill, judgment and experience. These techniques assume the reader has high performance driving knowledge and applies them as applicable to their level of driving experience.*

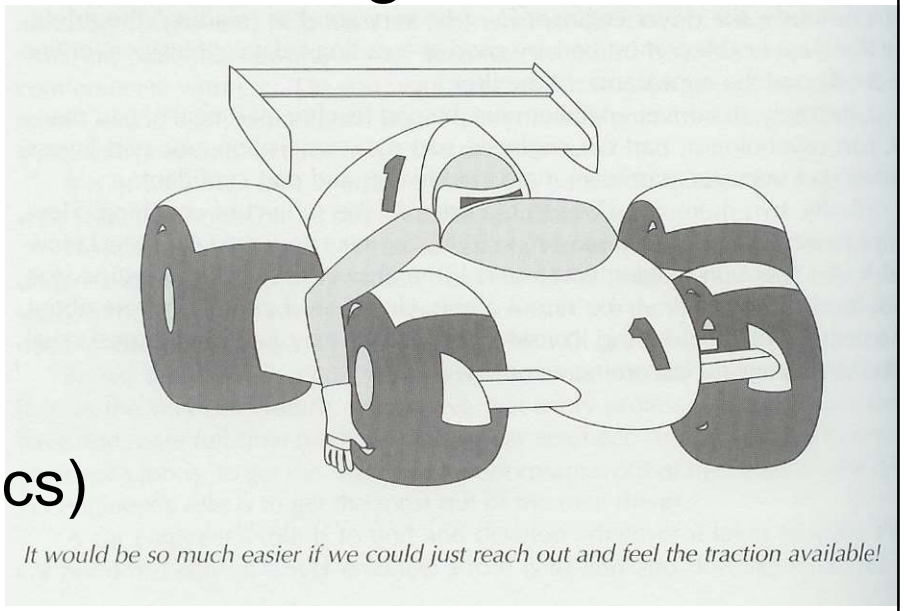
*High-performance driving can be very dangerous, carries inherent risks and may result in injury or death. NNJR and PCA make no warranty, guarantee or representations as to the absolute correctness or sufficiency of any representation contained herein. Nor can it be assumed that all acceptable safety measures are contained herein or that other or additional measures may not be required under particular or exceptional conditions or circumstances.*

# Understeer/Oversteer Agenda

- Definitions
- How to know / learn?
- Causes
  - Setup
  - Driver
- How to “fix”

# How to know/learn?

- Do you know if your car is understeering?
  - Oversteering?
  - Both (at different times)?
- Sensory input sessions
  - Sound
  - “Seat of the pants” (Kinesthetics)
  - Feel in the steering wheel
  - Vision: car’s path vs. intended path
- *PSM intervenes!*



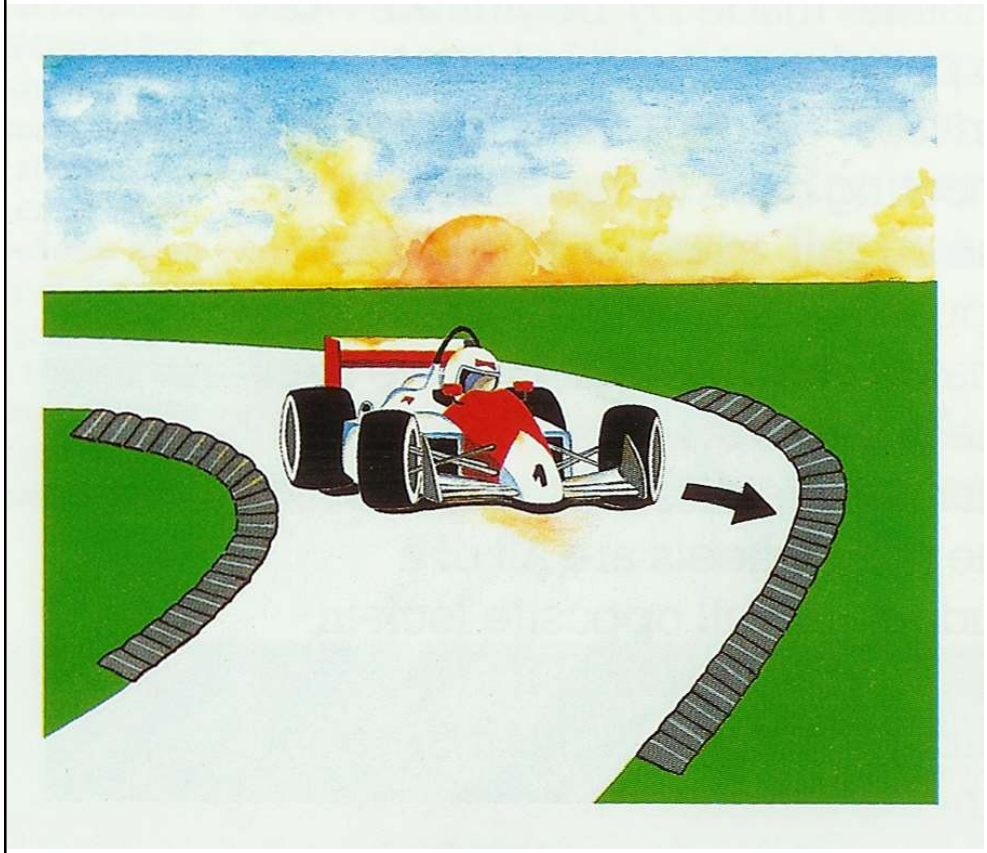
*It would be so much easier if we could just reach out and feel the traction available!*

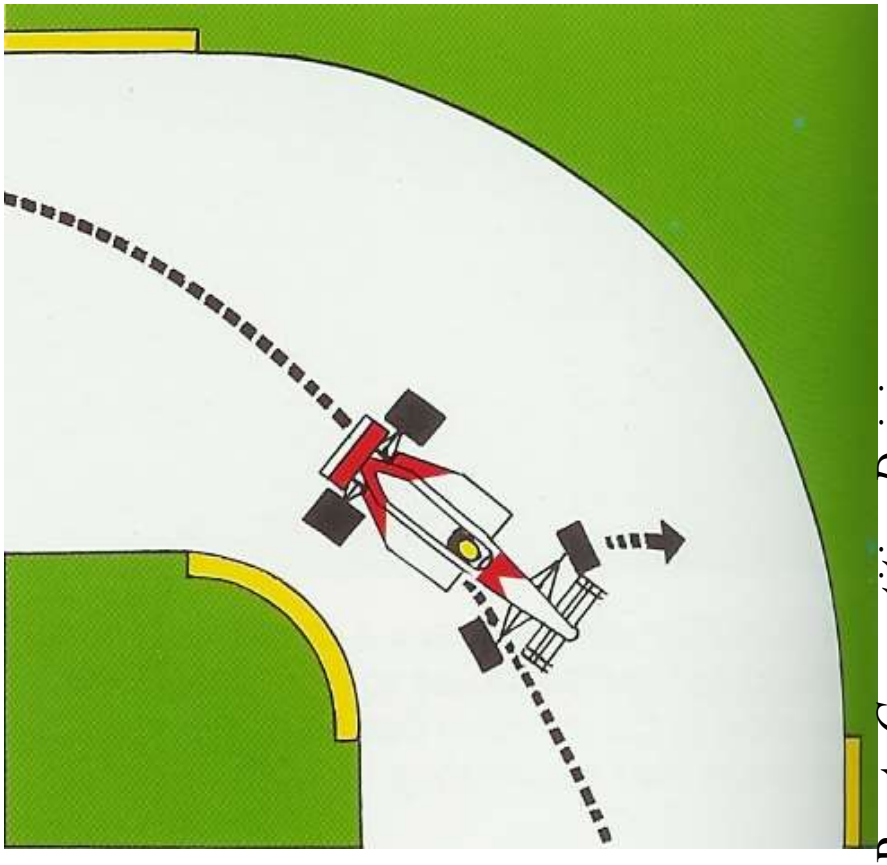
# Understeer: the car won't turn!

# Understeer

- Front tires have less traction than the rears – the car is not turning as much as you want
  - Increases radius of the turn
- Often referred to as “pushing”, “tight” or “plowing”
- The car is turning ***less*** than you had hoped and ***less*** than the steering input would normally dictate

# Understeer / Push





Alain Prost: *Competition Driving*

- "The car won't turn!"
- Front slip angle > rear slip angle

# Active Causes of Understeer

- Corner entry too fast: exceeding traction limits of front tires
- Steering input too rapid or too much steering angle
- Insufficient weight on front tires due to:
    - Abrupt brake release (on entry)
    - Too aggressive throttle (on exit)
        - –e.g. Turn 4
- Not releasing the wheel/steering angle on exit

# How to Fix Understeer

PREVENT (early, mid-corner)

- Slower Corner Entry
  - Brake earlier and/or harder
- More trail braking (maybe)
- Smooth Turn-In

COMPENSATE

- Straighten the steering
  - Opposite of instinct!
- Slow down / lift (carefully)
- Brake (maybe)

# Car Setup to Reduce Understeer

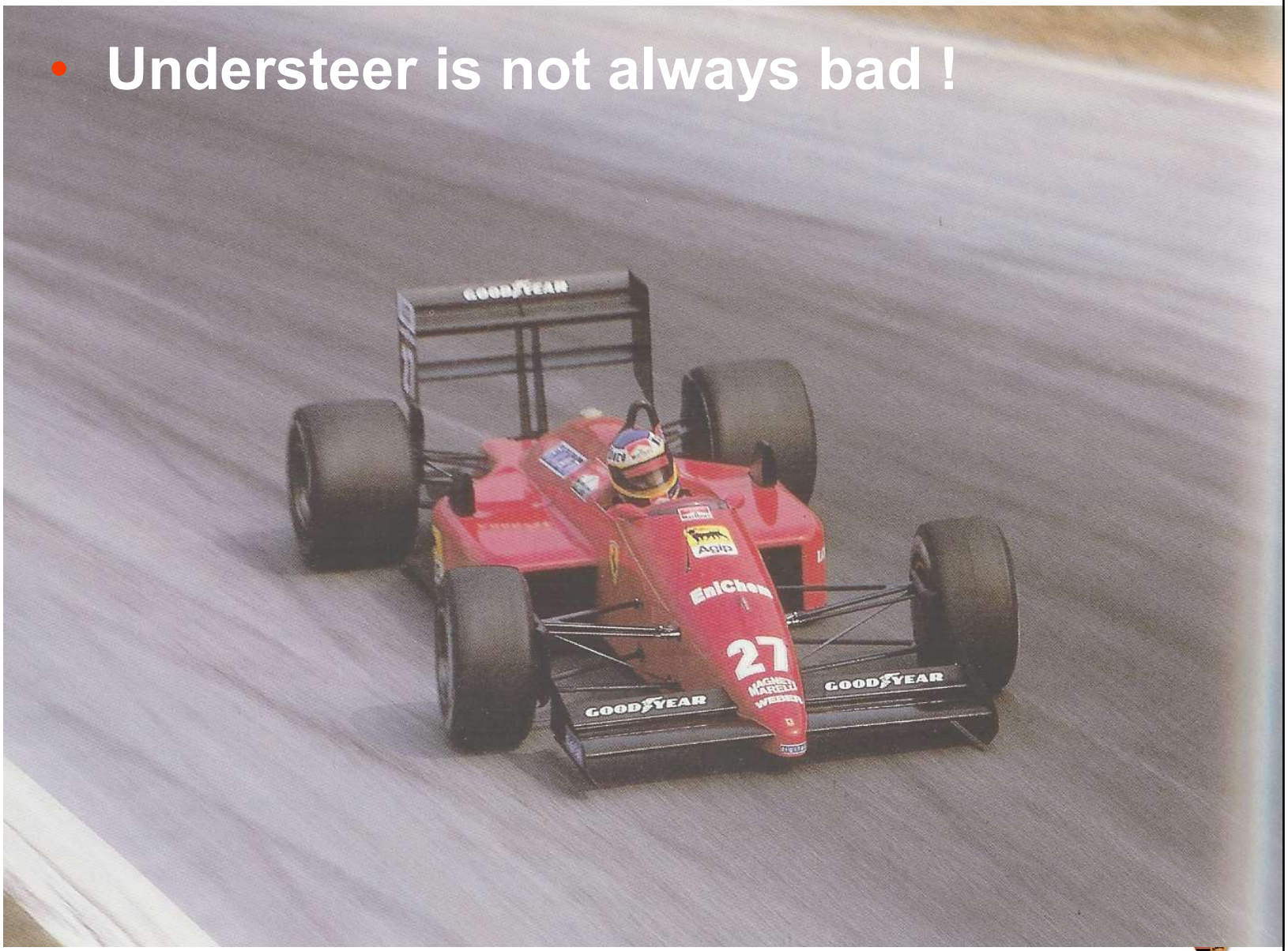
- Adjust tire pressures Front vs. Rear
  - e.g. +4 lbs in front
- Softer front sway bar or stiffer rear bar
- Larger front tires
- Increase front downforce (e.g. splitter)
- Stiffer front / softer rear springs (maybe)
- Shocks: reduce front low-speed bump (maybe)

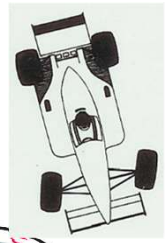
*Notes: Factory settings tend toward understeer*

*Assumes car setup within "normal" parameters*

# Understeer

- Understeer is not always bad !



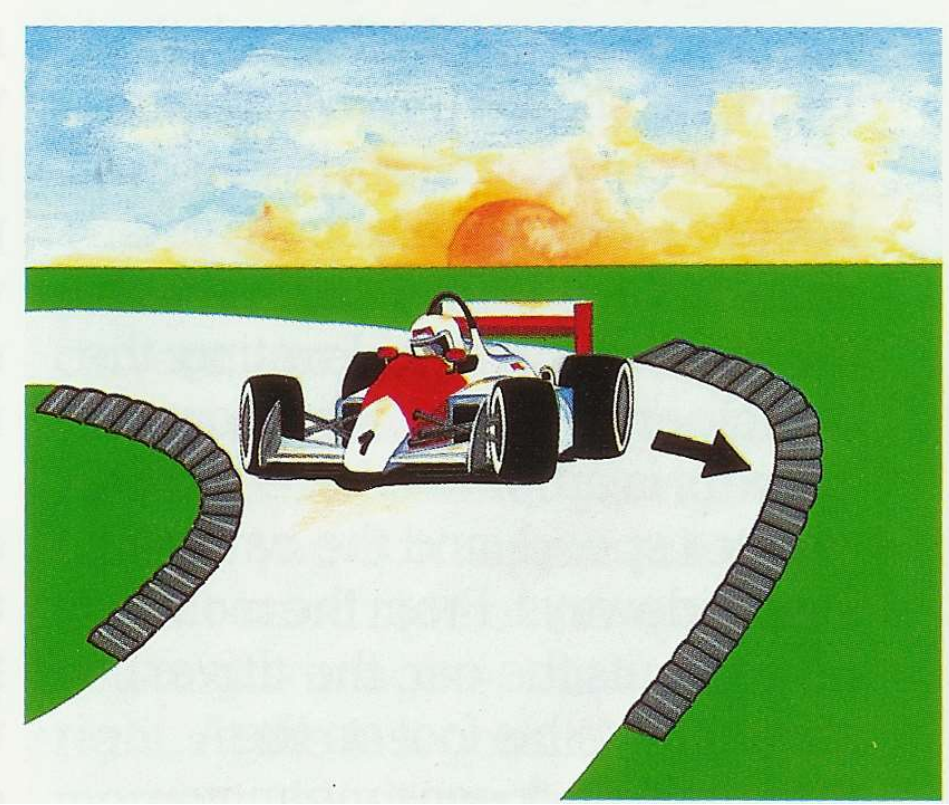



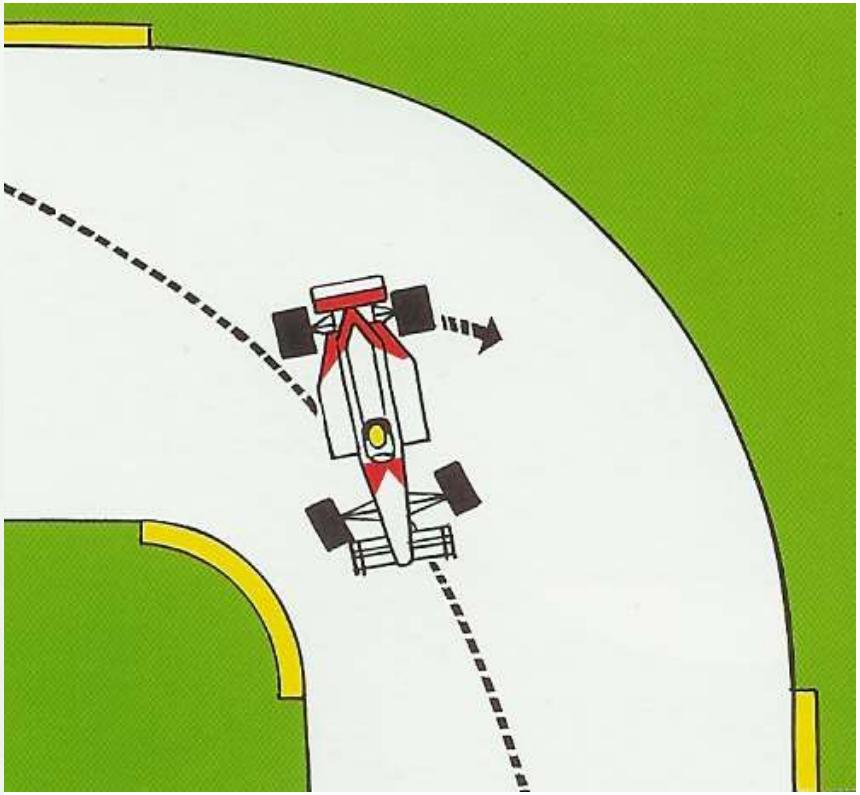
# Oversteer

# Oversteer

- Rear tires have less traction than the front tires
- Commonly referred to as “loose”, “fishtailing” or “hanging out the tail”
- The car is turning ***more*** than you had hoped and ***more*** than the steering input would normally dictate
- Car rotates so front points to inside of the turn rather than track out point.

# Oversteer / Loose





- "The car is turning too much!"
- "The car wants to spin!"
- Rear slip angle > front slip angle

Alain Prost: *Competition Driving*

# Active Causes of Oversteer

- Corner entry with excessive brake force
  - e.g. Turn 7
- Lifting off the throttle may result in “trailing throttle” oversteer
  - Weight transferred forward off rear tires
- Aggressive braking mid-turn
- Excessive steering input in downhill turn
- Power oversteer – throttle application too aggressive (high powered vehicles)

# How to Fix Oversteer

PREVENT

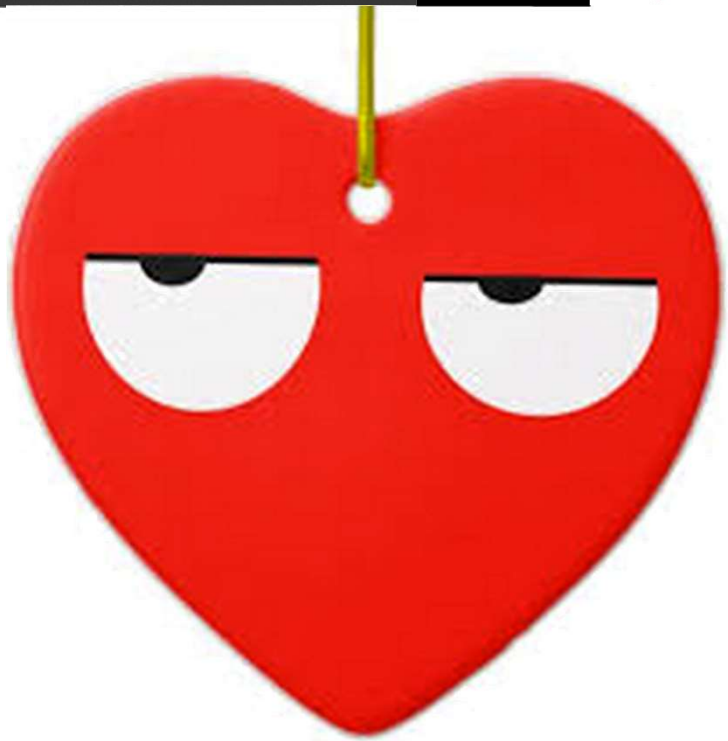
- Less trail braking (maybe)
- Smoother transition off the brakes
- Less and/or later gas (smooth!)

COMPENSATE

- Countersteer (requires practice!)
- CPR

# CPR

- **Correct** (steering input)
  - Do it NOW
- **Pause**
  - Allow the car to settle
- **Recover**
  - Bring the car under control
  - Use all the track you need
  - Sacrifice your line if you need more pavement to slow down



# Car Setup to Reduce Oversteer

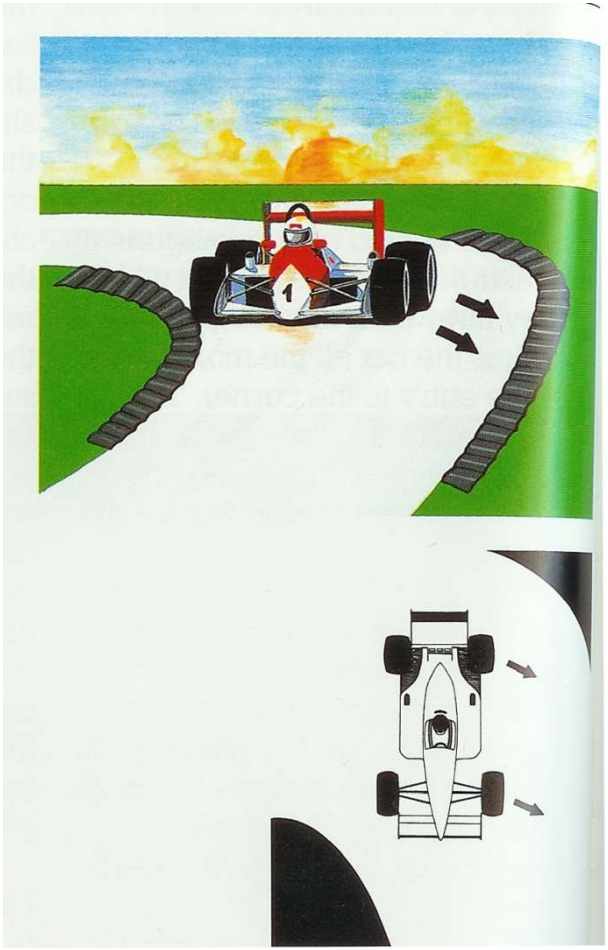
- Adjust tire pressures Front vs. Rear
  - e.g. +4 lbs in rear
- Softer rear sway bar or stiffer front bar
- Smaller front tires
- Increase rear downforce (e.g. wing)
- Stiffer rear / softer front springs (maybe)
- Shocks: reduce rear low-speed bump (maybe)

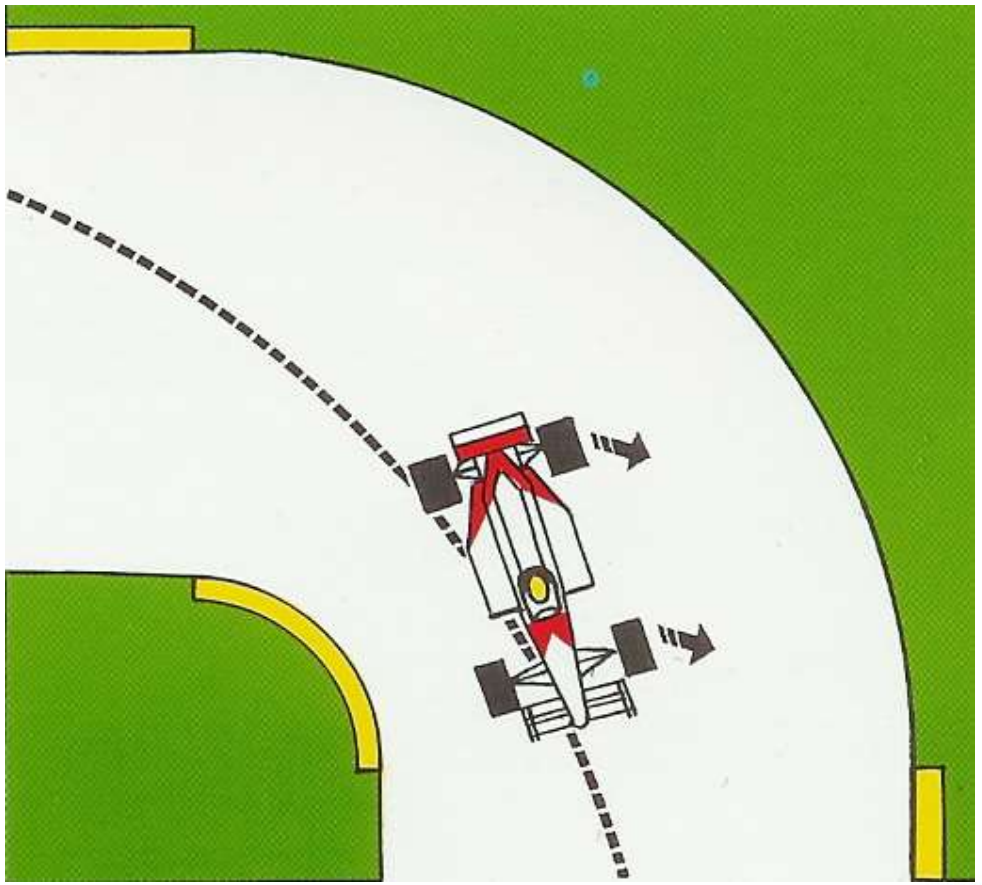
*Notes: Factory settings tend toward understeer*

*Assumes car setup within "normal" parameters*

# The objective: Neutral

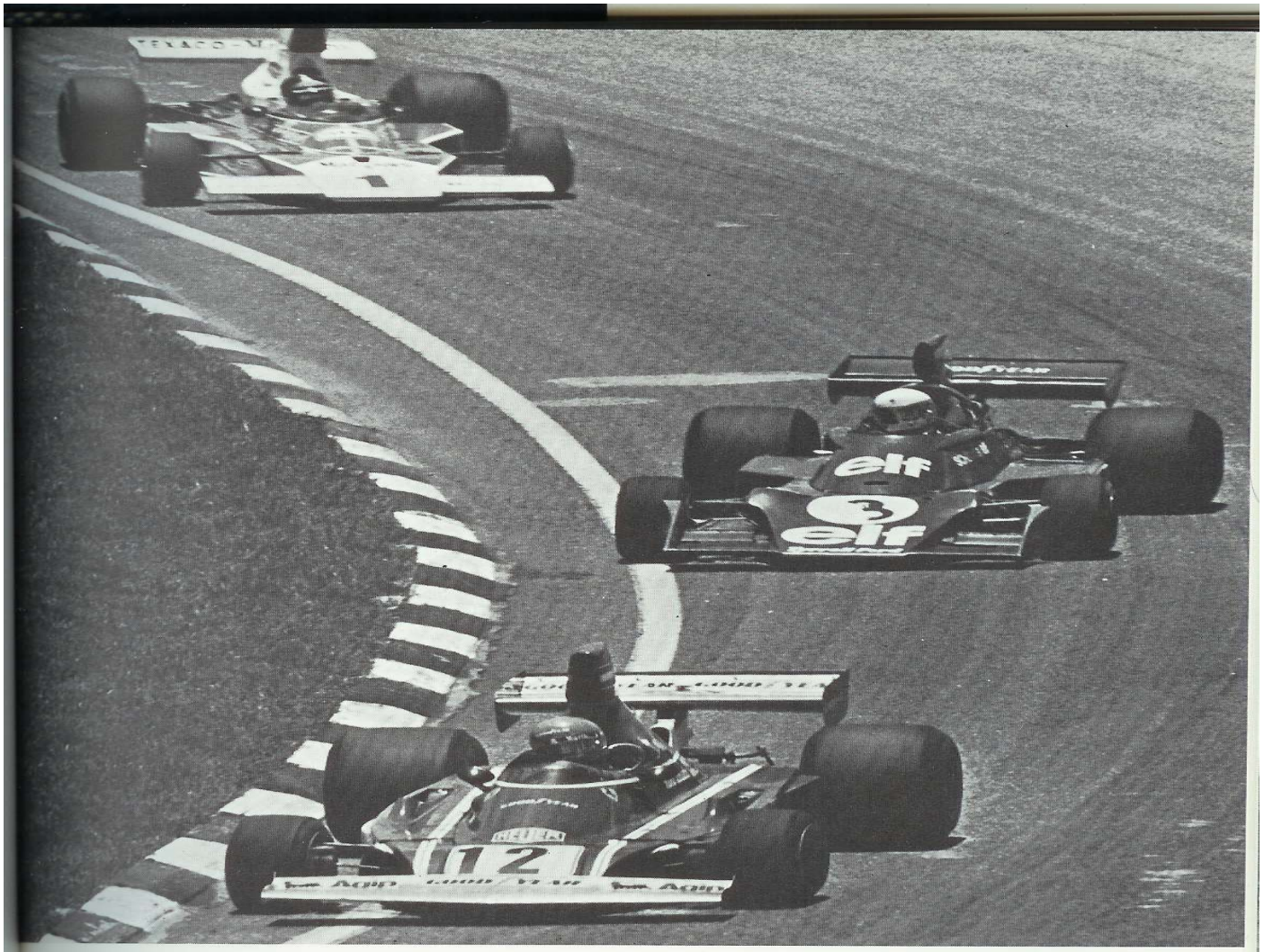
- Front slip angle = rear slip angle
- Steer with throttle and/or fingertips





Niki Lauda: *The Art and Science of Grand Prix Driving*

# Under, Over, Neutral !




*A remarkable photograph from the 1975 season showing three cars, each handling completely differently. My Ferrari (Number 12) is absolutely neutral; Jody Scheckter's Tyrrell (Number 3) is slightly oversteering, and Fittipaldi's Mclaren (Number 1) is heavily understeering.*

# Understeer/Oversteer Summary

- Must first know what the car is doing!
  - Sensory input sessions: kinesthetics
- Many “static” factors affect handling
- Cars can, and do, understeer and oversteer in the same corner
- In modern Porsches, most Understeer / Oversteer “handling issues” are caused by the driver, not the car

# Understand Why (Ross Bentley)

**Understand the *Why* so you can find the solution.**

Driving fast is not easy. Well, duh! Consider this:

- Trail braking too much can cause your car to understeer or oversteer on corner entry.
- Trail braking too little can cause your car to understeer or oversteer on corner entry.
- Getting on the throttle too hard can cause your car to understeer or oversteer exiting a corner.
- Turning the steering wheel too quickly at turn-in can cause your car to understeer or oversteer on corner entry.
- Getting on the throttle too early can delay getting to full throttle.

If one action can cause one of two reactions, how do you know how to fix it?

First of all, you need to understand the *why* behind each scenario, so let's look at each individually.

*Too much trail braking causing entry understeer:* You're asking the front tires to do too much - to brake and steer at the same time - so the tires give up and begin to slide. Reducing the amount of brake pressure will lessen or eliminate the understeer.

*Too much trail braking causing entry oversteer:* You're turning into a corner with too much weight on the front end, and not enough on the rear, causing the rear tires to slide. Reduce brake pressure to transfer some weight to the rear.

*Too little trail braking causing entry understeer:* You've come off the brakes, unloading the front tires, resulting in them sliding. Continue to trail brake a little more or harder.

*Too little trail braking causing entry oversteer:* You've come off the brakes fairly abruptly, causing the balance of the car to be unstable, resulting in less overall traction (and due to the way your car handles, it oversteers). Release the brakes more gently.

# Understand Why (Ross Bentley)

*Too hard on the throttle causing exit understeer:* Weight transfer issue - you've un-weighted the front tires, and they slide more than the rears. Be more gentle with your throttle application.

*Too hard on the throttle causing exit oversteer:* You're generating power oversteer, where you're breaking the rear tires loose (exceeding their traction limit), resulting in wheelspin and oversteer. Be more gentle with your throttle application.

*Turning the steering wheel too abruptly causing entry understeer:* The sudden turn of the front tires means they haven't been given enough time to generate the side forces, so they "give up" and slide. Be more gentle with your turn-in.

*Turning the steering wheel too abruptly causing entry oversteer:* The sudden change in direction results in the rear being "whipped" to the side, and that momentum continues, resulting in the oversteer. Be more gentle with your turn-in.

*Getting on the throttle too early results in being late to full throttle:* You apply the throttle early (because you've been told over and over again that exit speed it critical) - so early that the car has not rotated enough around the corner that you have to breathe the throttle (to avoid driving off the track) before you can fully commit to full throttle. Getting to full throttle is what matters most, not when you start giving it a partial throttle. Hesitate very briefly, to the point where you can go all the way to full throttle in one application.

I've found that in most cases, once a driver understands the cause and effect of each of these scenarios - the *why* behind them - he or she becomes more aware and begins to sense what leads to what. And that's the key to addressing each of these issues.

Nobody said it would be easy.