



Motorcycles and Autonomous Trucks

Predictability, Perception, and Safe Interaction



Why I Was Asked to Speak

- 25 years coaching riders-California Superbike School
- World-class program: US, UK, Australia
- Later: US Marine Corps rider safety program
- Three consistent crash causes: failure to see, brake, or steer
- Now: Head of Cybersecurity, Bot Auto

Two worlds: Motorcycle dynamics and AV systems rarely in the same room.



A Story About Physics



A Story About Physics

What would our truck have done?

Is “don’t hit the car” always the right answer?



SECTION 1

The Autonomous Truck

What it does. How it thinks. Why it's different.

One Job: Drive Safely from A to B

“Boring is a feature.”

Everything that follows is a consequence of that single constraint.

- Not trying to be fast, efficient, or impressive
- Not trying to make up lost time
- Optimized entirely for safe, predictable delivery



What Boring Looks Like in Practice



- Smooth, gradual acceleration, braking, and steering
- Stays in the right lane when possible
- Positions for exits and turns well ahead of time
- Uses turn signals reliably and early
- Never has a bad day
- No phone, no food, no fatigue

Physics Are Still Physics

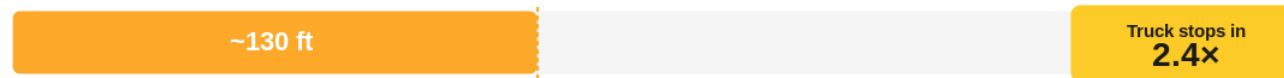
A Class 8 truck: Up to 80,000 lbs.

Stopping Distance from 60 mph

Braking distance only · Ideal dry pavement · Full brake application

Motorcycle

good technique, modern tires



Class 8 Truck · 80,000 lbs

loaded combination vehicle · FMCSA standard



Dark segment: air brake system lag (~40 ft before brakes engage) · Reaction time not included for either vehicle



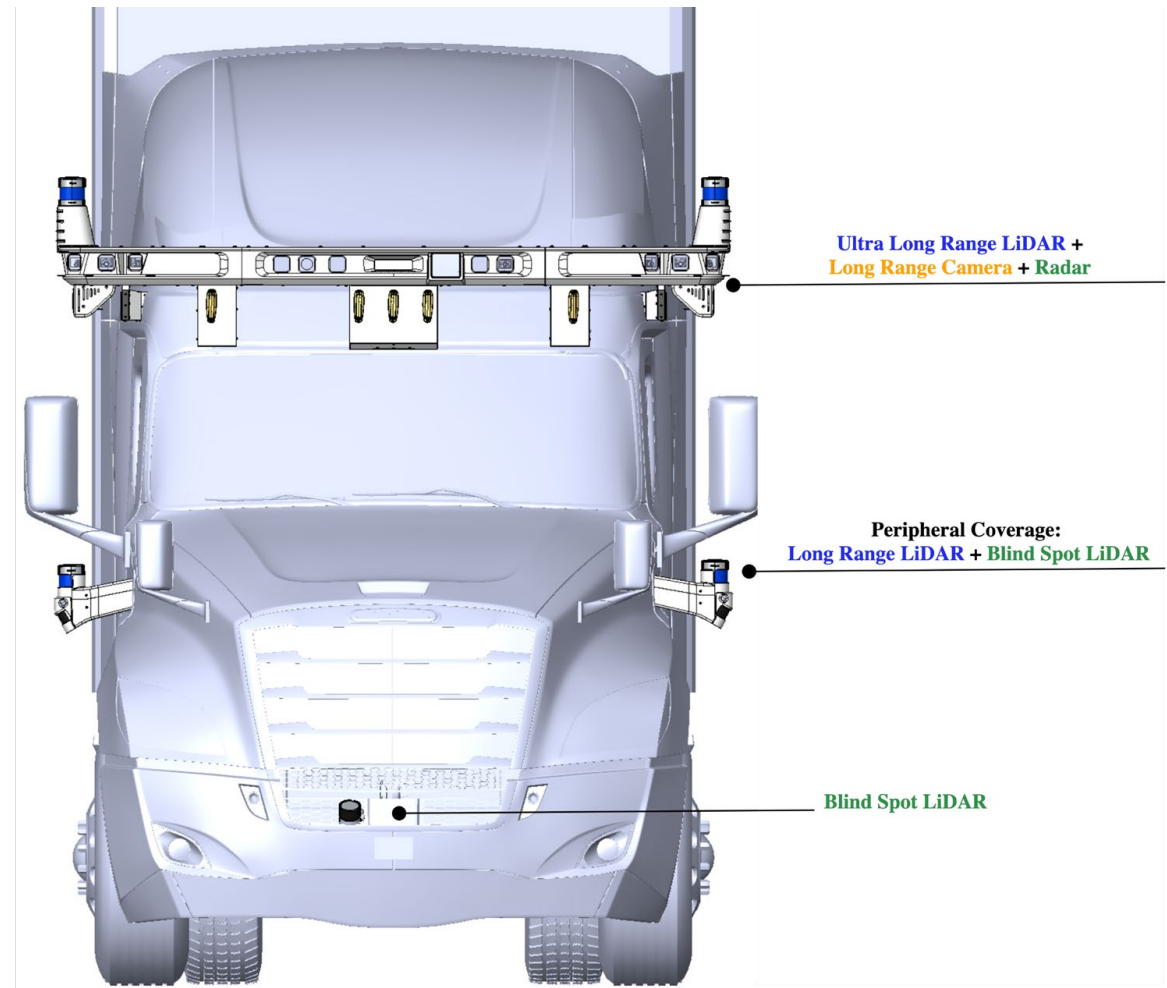
-- A football field is 300 feet --

- Motorcycle brakes are better than a truck's
- Mass and momentum cannot be engineered away
- Conservative following distance is not optional

Space is the margin that physics requires.

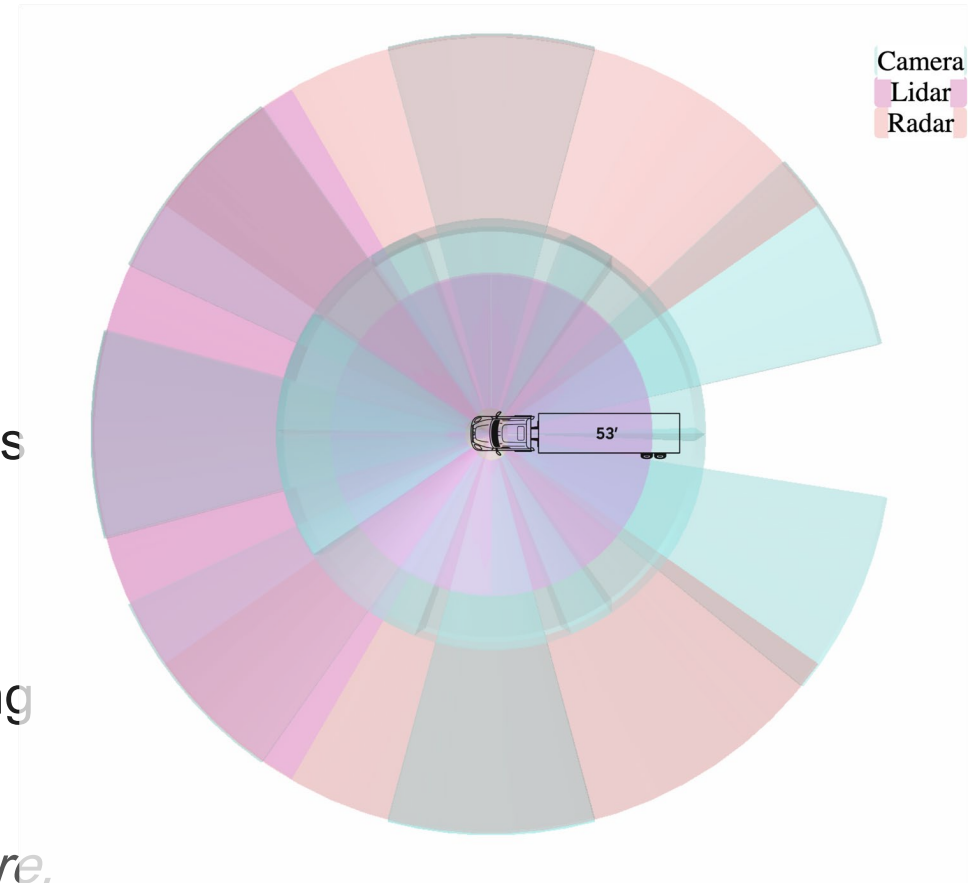
Autonomous Vehicles 101

- 15 Cameras, 8 Lidar, 3 Radar
- Some sensors see out to 500m
- Sensors are redundant
- Actuators are redundant
- Sensor pipeline to perception output in $< 1/10$ th of a second



Perception: 360° at All Times

- Not 360° “when it checks”—continuously, simultaneously, without gaps
- No fovea: no center of attention that must be redirected to see something clearly
- No blind spot in the attention sense
- Can detect objects within ~18 inches of the truck’s sides
- Anticipates developing situations—positions proactively to avoid being forced into physics-defying scenarios



The truck doesn't “look” at something to know it's there.

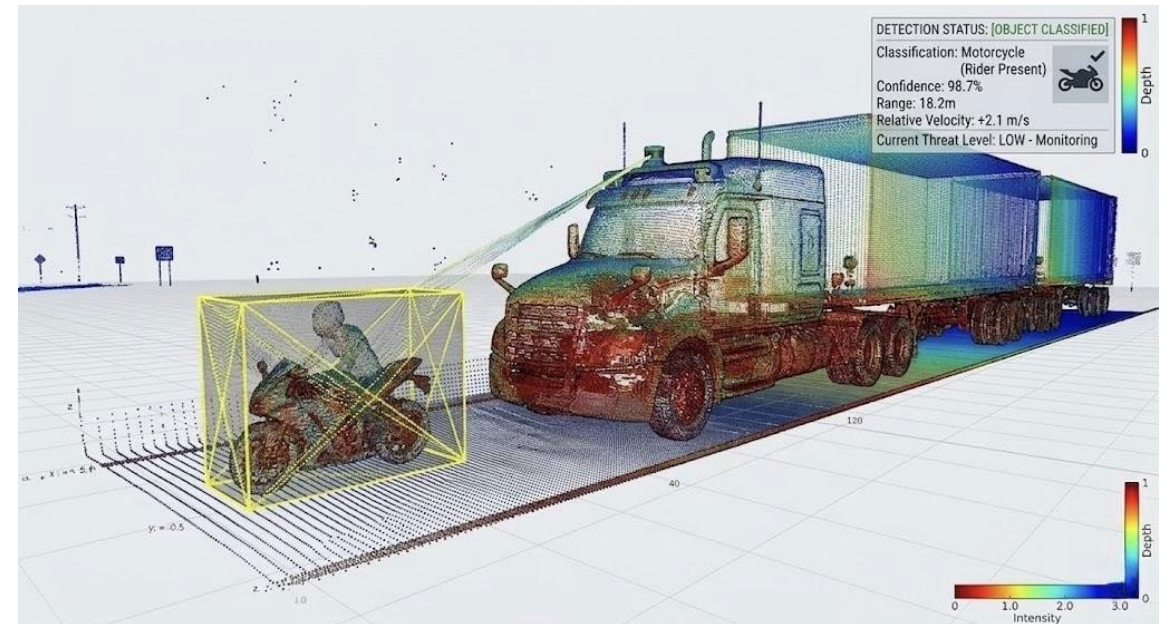
Detection vs. Prediction

Seeing a motorcycle is not the hard part.

Predicting what it will do next, with enough margin to act, is.

Prediction confidence depends on:

- How stable the motorcycle's trajectory has been
- How much time and space are available
- How consistent the rider's behavior has been in the preceding seconds



When confidence drops, the truck slows and holds lane. This can look hesitant. It is intentional.

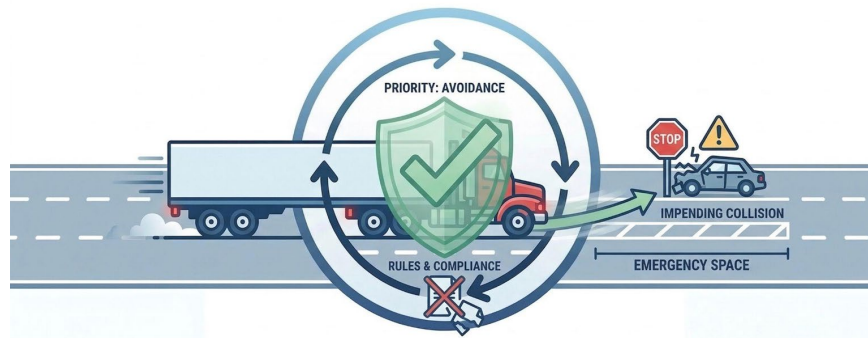
Legal Compliance and Edge Cases

- Our trucks are legally constrained at all times



- Other road users are behaviorally unconstrained the truck responds to what it observes, not whether it is legal

- Safe response depends on available time and space, not on who is “right”



- The truck prioritizes collision avoidance over rule enforcement

SECTION 2

How Humans Actually See

The truck maintains 360° awareness at all times.

Now let's talk about what ~~we~~ we are doing while that's happening.

The Eye Doesn't Work the Way You Think

We feel like we see continuously. We don't.



- Eyes jump between fixation points in rapid movements called saccades
- Between each jump, the brain suppresses visual input —saccadic masking
- Fastest movement the human body produces: up to 700–800° per second
- Once initiated, a saccade cannot be redirected —it is ballistic

The brain stitches fixation points together into the illusion of continuous vision.

The Numbers

3-4

saccades per second

150ms

vision suppressed per saccade
(15 ft @ 70MPH)

~2 hrs

visual blindness per day
(saccades + blinks combined)

You cannot stop this. It is happening right now.

The 2hour figure combines saccades and blinks both involuntary.

But only one is trainable.

What This Means for Riders in Traffic

The active scanner (darting eyes):

Maximizes blind gaps. May also produce micro-movements in lane that AV sensors must track.

The fixated rider (target fixation):

Sees only one thing. Routes all threat detection through the slower foveal pathway. Will steer toward the obstacle.

The wideview rider (“thousandyard stare”):

Engages the faster peripheral motion detection system. Detects threats up to 200ms sooner. Preserves the subcortical looming reflex—responding before conscious awareness.



VIDEO: Eye Tracking at Vegas

Watch where this rider is actually looking.



The Contrast

Untrained Rider

Sequential sampling

3–4 fixations/sec

Gaps every saccade + blink

One thing at a time

Trained Rider

Pre-located, deliberate shifts

Reduced saccades

Blinks remain, saccades cut

Broad field, motion priority

Autonomous Truck

Continuous, simultaneous

All objects, all the time

No gaps of any kind

Full 360°, always

SECTION 3

The Visual Skills

We called it coaching. Now we know it's neuroscience.

The Foundation: Reference Points



- Specific, repeatable visual markers: turn point, apex, exit
- Give the rider's eyes somewhere to go intentionally
- Without RPs, eyes hunt. Hunting means saccades.
- With RPs, the eye moves to a known destination—slow, deliberate

The truck always knows its position relative to lane markings and infrastructure. Reference points are the rider's equivalent

Staying Ahead of Your OODA Loop

Two-Step:

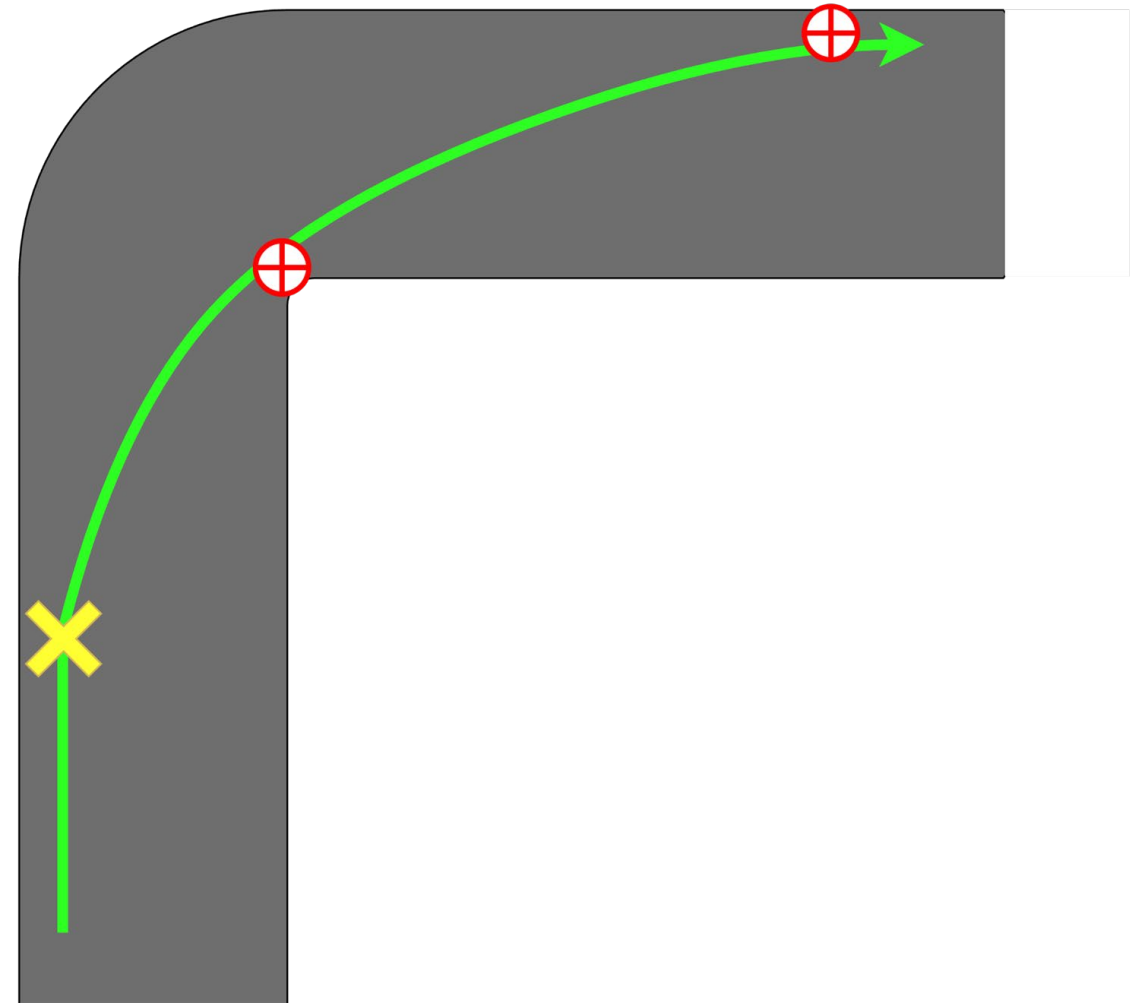
About half a second before the turn point, shift focus to the apex. The steering input follows a decision already made.

Three-Step:

Once pointed at the apex and confident of hitting it, shift focus to the exit. Visual flow runs ahead of action.

The principle:

The observe/orient cycle runs one action ahead of the execute cycle. You are never reacting to the present moment you are executing a plan you made half a second ago.



Wide View Transitions: The Synthesis

- Maintain a softened, wide field of view throughout —not fixating, absorbing
- Each reference point is pre-cue'd in peripheral awareness before the eyes move to it
- Eye movements become slow, deliberate transitions —not saccades
- Visual flow becomes continuous rather than stroboscopic

The crux:

Blinks cannot be trained away. Saccades can



The wide view, combined with the three-step, replaces hunting with intentional transitions.

Evidence: The Marine Corps Program

More Marines lost to motorcycle crashes than combat operations in Afghanistan in 2008.



CSS evaluated the top crash causes:

- Failure to see the threat
- Failure to brake effectively
- Failure to steer effectively

The training addressed all three.

Among the first 1,000 trained: Four years later, two careening injuries. No fatalities.

SECTION 4

For Motorcyclists

Practical guidance—framed as what to do, not what to avoid.

The Shared Currency: Predictability

Motorcyclists and autonomous trucks share the same goal:

Predictable, stable interactions.

- The truck plans around what it can observe and predict
- A stable, intentional rider is easy to plan around
- An ambiguous rider creates uncertainty—the truck's response: slow and hold

Clear intent is easier to plan around than fast intent.

What Not To Do Near an Autonomous Truck



What To Do Near an Autonomous Truck



18 inches: detection capability, not a comfort margin.

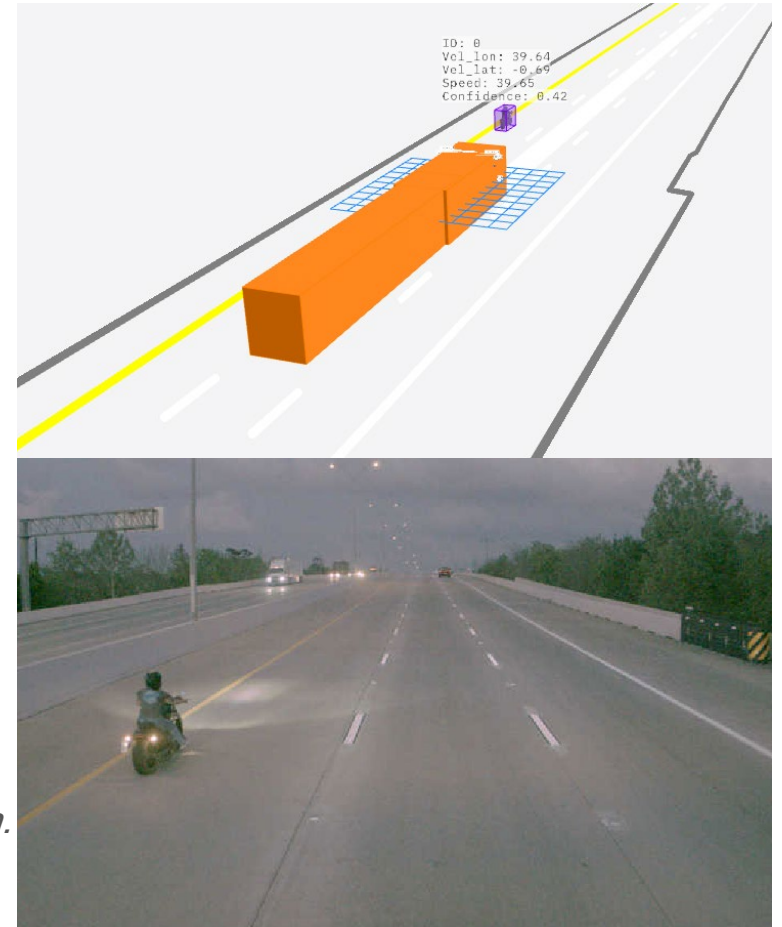
- Hold a stable position—establish yourself, don't hover
- Make lane changes deliberate and complete
- Pass with margin, not precision—wider is clearer
- Expect consistency, not courtesy—the truck won't wave you through
- When traffic gets complex, the truck simplifies: slows, holds lane

The Wide View in Traffic—Not Just on Track

- Maintain the thousandyard stare: process space, not objects
- Let peripheral motion detection flag encroachments before foveal attention is needed
- When something requires attention, move eyes slowly and deliberately—not in a saccade
- Stay ahead of your own OODA loop: ~~pre~~ create the next point before you need to look at it

The autonomous truck is the most predictable vehicle on the road.

The challenge , and the opportunity, is for the rider to become as predictable in return.



**“Safe traffic is not about who has the right of way.
It is about who is predictable.”**

Andy Burnett | Bot Auto

Texas Transportation Institute | April 2026