

The Trailing Edge

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These Are A Few of My Favorite Motions

There are certain vehicle motions that I can only describe as visceral bliss - and I just experienced a new one!

These motions are subtle and specific, but represent some of the most incredible parts of the interplay between humans and machines. I love experiencing them to such a degree that, when I had dislocated my shoulder and was told to "go to a happy place" while they set my joint back in the socket, I instinctively thought of this feeling.

Before describing these motions, it's worth stating what they aren't. I'm not talking about fast accelerations in a car, absurd roll rates in an airplane, or even zero G. Those are, objectively, incredible sensations, but none of those are on my list of top two - now top three - things to experience in a moving vehicle.

Here, then is my list of Vehicle Motions of Visceral Bliss

Feeling #1 - The Onset of Oversteer (Enter the Drift)

I love drifting. In fact, I adore drifting. This is a skill I discovered on video games, practiced on rental cars, and refined on my own cars. There's so much to say about the feeling of drifting. There's the decoupling of attitude and velocity through large sideslip that has your head turning to the side to see where you're going. There's the sensation of stabilizing a drift with small, anticipatory steer inputs. Of course, there's also the coupling of throttle to directional control and stability.

All objectively wonderful things, but the visceral sensation that captures my heart the most is the very onset of oversteer at the first indication of a drift. Under normal circumstances, a typical car responds to steer inputs with a proverse yaw rate and a build up of lateral gs. With drifting, the rear tires are made to have less lateral traction than the front tires, causing the car to over-steer the turn compared to the steer angle. I feel this sensation in my bones. It's an upset to the usual dynamic contract I have with my car, where it responds in proportion to my input. At the onset of a drift, the car rotates faster and to a greater degree than before. It is now unstable, and will soon demand counter steer so that the front lateral traction matches the rear.

This onset of oversteer is a clichéd metaphor for what comes next. "Forget everything you know about driving and steer the other way!". It's a transformation of a car from a well-behaved system with a reasonable understeer gradient to one that is loud, unstable, and demands considerable driver workload to just maintain equilibrium. It's hard for me to describe in words how much I crave this sensation when purposeful, and similarly, how alarming it is when not.

Feeling #2 - Raising the Tail

Most airplanes transform discretely between wheeled vehicles and wing-borne vehicles. They roll along the runway until it is time to fly, and then do so. You can make arguments about weight on wheels and rotation speed - but most airplanes either are flying or are not. Taildraggers are different. Taildraggers are airplanes that have the main wheels slightly ahead of the center of gravity and a small tail wheel all the way in the back. This configuration, in contrast to a tricycle gear airplane, is harder to fly - but also gives rise to the second incredible visceral sensation.

When a tailwheel airplane starts a takeoff roll, it accelerates initially on all three wheels - gathering speed and blowing aerodynamic pressure over the wing and the tail. While the wing certainly starts to generate some lift, it is the tail that enters the aircraft into the domain of flight. Early into the takeoff roll, the tail generates enough lift force to raise the tail and pitch the nose down. The pilot, whose forward view may be blocked by the nose-up attitude, now sees the runway ahead clearly and with better perspective. The tail is flying, even though the wing is not, having not achieved sufficient speed yet to lift the entire airplane.

This motion and the resulting feeling are so unique to taildraggers. Nothing in my preceding hundreds of flying hours prepared me for the overwhelming sensation of having part of the airplane start to fly while the rest waits patiently. A tricycle gear airplane just rotates and lifts off, whereas a tailwheel airplane pitches DOWN initially as it accelerates to rotation speed.

It is an indescribably-satisfying feeling to pilot an aircraft that is operating both on aerodynamics and tire contact forces. The airplane, briefly, rolls around with the tail flying but much of the weight resting on the wheels. It is that very transition from a three-wheeled ground vehicle to a two-wheeled plus tail hybrid vehicle that is seared into my memory and happiness. This is the happy place I went to as the pain of my shoulder injury mounted.

Of course, the reverse motion is true for wheel landings. The airplane first lands on the main wheels, and later the tail lowers as the airplane decelerates on the runway. I am in love with both of those sensations, but it is the raising of the tail that carries with it the promise and freedom of a flight to come.

Feeling #3 - Hovering a Helicopter

I wonder a lot about transferable knowledge. If I can do one thing, what does it say about my ability to do something similar? I can fly remote controlled helicopters and first-person view racing drones. I understand swash plate mechanics, and can appreciate the workload needed to stabilize a vehicle in a steady hover - but what about an actual helicopter? How is it different when I'm seated IN the unstable hovering vehicle?

The verdict?

It turns out the experience hovering models IS transferable and that the exhilaration of the subtle hovering motion rises immediately to a spot on my viscerally blissful motion list. It is not easy to hover precisely. It requires considerable workload on four axes simultaneously to manage the unstable, coupled machine. Achieving equilibrium is hard won, but comes with it a set of non-minimum phase motions that is, once again, indescribably beautiful.

Take something as simple as an unwanted descent. As the helicopter settles, the pilot adds collective pitch to increase the lift. That lift incurs a torque penalty, causing the nose to swing to the right unless the pilot steps on left pedal. The tail rotor dutifully generates a force to the left, which moves the helicopter slightly to the right and demands the pilot give left cyclic input to keep it in place.

Now that the helicopter is tilted slightly, it resumes the unwanted sinking!

It is a wonderful parade of inputs and responses to manage the controls of a helicopter in a hover. Small, anticipatory inputs feel like taking the difference of two very large numbers. The helicopter can generate enormous forces quickly, so to have it hover in place is an exercise in negotiating the simultaneous balance of all those forces in all those axes. Meanwhile, that blissful motion feels something like the combination of being swung around on a tire swing while trying to balance standing up on a basketball.

There's that famous quote that is sometimes attributed to Leonardo Da Vinci - "When once you have tasted flight, you will forever walk the earth with your eyes turned skyward. For there you have been, and there you will always long to return."

Of course, this is true generally, but also specifically for those moments of visceral bliss.

I drifted once, and now I long for that feeling in every car I drive.

I felt the tail start flying, and now I long to have sensation every flight.

I hovered briefly, and now all I want to do is sit a few feet above the runway, furiously mixing the controls to have the helicopter do virtually nothing but stand in place.

- Mujahid Abdulrahim