Applied Bicycle Science

I.   FROM TEXACO TO MOE'S

The air feels like it did
when we used to buy
outrageously fruit-flavored gum
whose scent made it to the end
of the short gas station aisle
where we would go after school
with change from my dad's
sock drawer change cup.

It afforded us the flirt
before our parents were home from work,
in the strange interval
before we knew how to kiss
and after we'd become addicted.

That gas station,
where my buddies and I
would hide our bikes behind
the dumpster and wait for cars
to not use all of the time
allotted by the automated
car wash blow dryers
so we could run toward them
and jump,
    be blown back,
or lean our faces in
to feel our cheeks morph
as if on high speed missions,
    that gas station,
where the repetition
of pulling into pump two
from Candelaria
taught me what side of the car
my gas cap was on,
    that gas station sold itself,
and Moe's Bagel World
put in a new and out of place sign
that featured a torus
with continents and sea.

It was there,
at Moe's
that I stood behind you
with my fingers tucked
into the pocket of your tight jeans,
you reaching back
to tuck your thumbs in mine
as we looked at the menu
hanging over the counter,
and you asked me,
"How can a bagel world
not have cinnamon-raisin?"

II.   TRANSITION

Then later I became someone else
and sailed small arcs of the earth
to meet people I didn't recognize.

III.   SEXUAL CHESS AND THE DAM OF INHIBITIONS

Her eyes paused on my socks. They were yellow socks under Birkenstocks. They were orange—pumpkin really, but it was October—almost October. I wondered what she thought, but was forced to plow confidently through.

She had a bowl of green beans? lima beans? some podded bean, and she was sitting outside, plastic chair and table, reading and watching people in the street. I was one of them. I stopped to talk. Pant rolled up to bike, I walked the silver Schwinn across the street.

That's when she saw the sock. Then she offered to share her beans. My pod-the one she handed me-had two. I ate one smoothly, and one shot sideways, landed on the walk. I felt for a third. It wasn't there. "Not a pro" she said.

"Not even good," I returned. Well, she was sure she'd see me around. "Two for Tuesdays at the pub," I advertised, "I'm probably gonna head over there later." I shied from the formal invite, cranked away with a forced smile.

> Should I play?
> I want sex. I want to connect.
> I guess I have to.
>
> He looks at her, gets the eye contact.
> His smile and hi are a knight onto the board.
>
> Quick—I need a strategy.
>
> I don't want a fucking strategy.
> Clothes off is not mate in two.
>
>> In a room, a town, a planet of others
>> thirsty for love
>> we could be coherent veins,
>>
>> but inhibitions construct dams,
>> transform rivers into reservoirs,
>> pools to evaporate.

IV.   BICYCLE PHYSICS

A.   Aristotle, Galileo, Newton and the First Two Laws of Motion

Aristotle asked the question, "Why do things move?" and it seemed obvious that forces give objects motion. Then he asked, "What keeps them moving?" In the case of the cart it was the ox, but what about the arrow? Two thousand years later Galileo said, "The question needs no answer. Moving objects have an intrinsic quality of motion." Late that century, Newton set that thought in stone as his first law of motion:

> *A body in motion retains its motion.*
> *A body at rest remains at rest*
> *unless acted on by a force.*

Each body in motion, the way Newton tells it, has mass and velocity. We call the product of these two momentum (p).

$$\overrightarrow{p} = m\,\overrightarrow{v} \tag{1}$$

A vector is a quantity with magnitude and direction. The arrows indicate vectors. Mass is just a number, just something sitting there. But velocity is defined as speed with direction. Therefore it's a vector. The momentum vector doesn't change until it feels a force.

$$\vec{F} = \frac{d\vec{p}}{dt} \tag{2}$$

Force is the time derivative of momentum. This is Newton's second law. A force capable of twisting is called a torque. On a bike this could be wind, gravity, or the rider's own tendency to lean.

B. Momentum and the Steering Trail
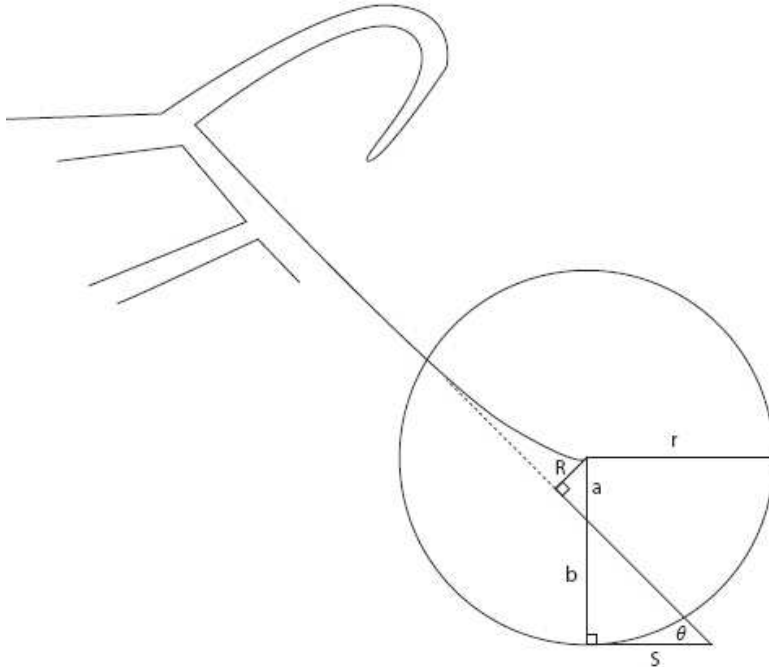
Fig. 1 introduces the geometry.

FIG. 1: Schematic demonstrating the geometry discussed in Eqs. 3-6.

We're concerned with the steering trail and the head tube angle. Here's a derivation relating the two.

$$a + b = r \tag{3}$$

$$\cos\theta = \frac{R}{a} \quad ; \quad \tan\theta = \frac{b}{s} \tag{4}$$

$$a = R\sec\theta \quad ; \quad b = S\tan\theta \tag{5}$$

$$S = \frac{r\cos\theta - R}{\sin\theta} \tag{6}$$

We see that the steering trail varies with the headtube offset, R, known as the rake, and the headtube angle. At the limit where the steering trail goes to zero, the bike has the greatest tendency to respond to torque in a way that balances. But as the steering trail vanishes, the rider loses the ability to communicate with the bike. An intermediate angle and a moderate rake lets us roll into our momentum while maintaining the ability to curve and corner. Engineers apply this. Most bikes have a headtube angle around seventy degrees and a rake of a few centimeters.

C.   Conservative Fields

A force field is a region of space inside which a particle feels a force. We live in a force field. The earth's gravity pulls us in. A force field is said to be conservative if work done against the force can be returned as work done by the force. Mathematically,

$$\oint \overrightarrow{F} \cdot d\overrightarrow{r} = 0 \tag{7}$$

The net work required to move an object around a closed loop is zero. Gravity has this property. Work done to get up a hill is returned as acceleration back down. At the top it pushes us, and on the geometry of the bike we glide smoothly.

D.   Conclusion

Get going and the rest is taken care of. Inhibition is a waste of time.

V.   THE STORY OF THE SILVER SCHWINN

I went to the sports recycler to check out used bikes. There was a Schwinn, circa nineteen seventy—giant, silver, classic. I took it for a test ride. The frame was too big, but with the seat low it fit well. The price was right, so I rode it home. Not until later did I notice the steering trail on this jewel allowed for all–out–no–hands pedaling, confident hill bombing, and turns from one street to a perpendicular without a touch of the bars.

When gravity is working for me I let go of the bike, stand on the pedals with hands out and let cool air rush my layers. But staring at the point of perspective, I still see the handlebars. I don't want to know they're there.

I've just eaten the bean, and now I realize it was edamame, of course—the coolest podded bean around. I pedal to the top of Pleasant St., turn onto fifth, then ride the hill to speed. I hop onto the frame and stand full height on the bike, spread my arms as if the axis to the wheels.

Head back under stars, I float in an effortless orbit around the last night of September where I am a streak to the lamp–lit red leaves who are themselves on a ride they need not control.