



The Nature of Predictions

Negative Feedback Loops \wedge P.I.D Controllers

Internal Training Session

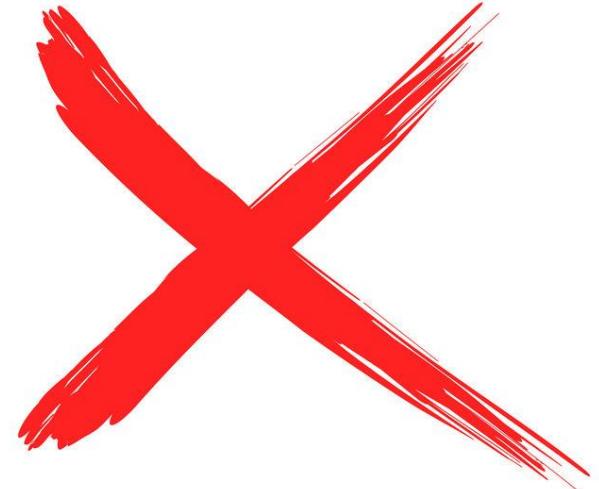
Dr. Staffan Canback

Executive Chairman, Tellusant

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“The purpose of a prediction is to help with planning and decision-making in the present by anticipating possible future developments.”

Gemini



Too restrictive
Too imprecise
“Not even wrong”

Predictions are everything in life (and in other places)

Who predicts?

- **Bacteria**
- **Rabbits**
- **Humans**
- **Societies**

What do we predict?

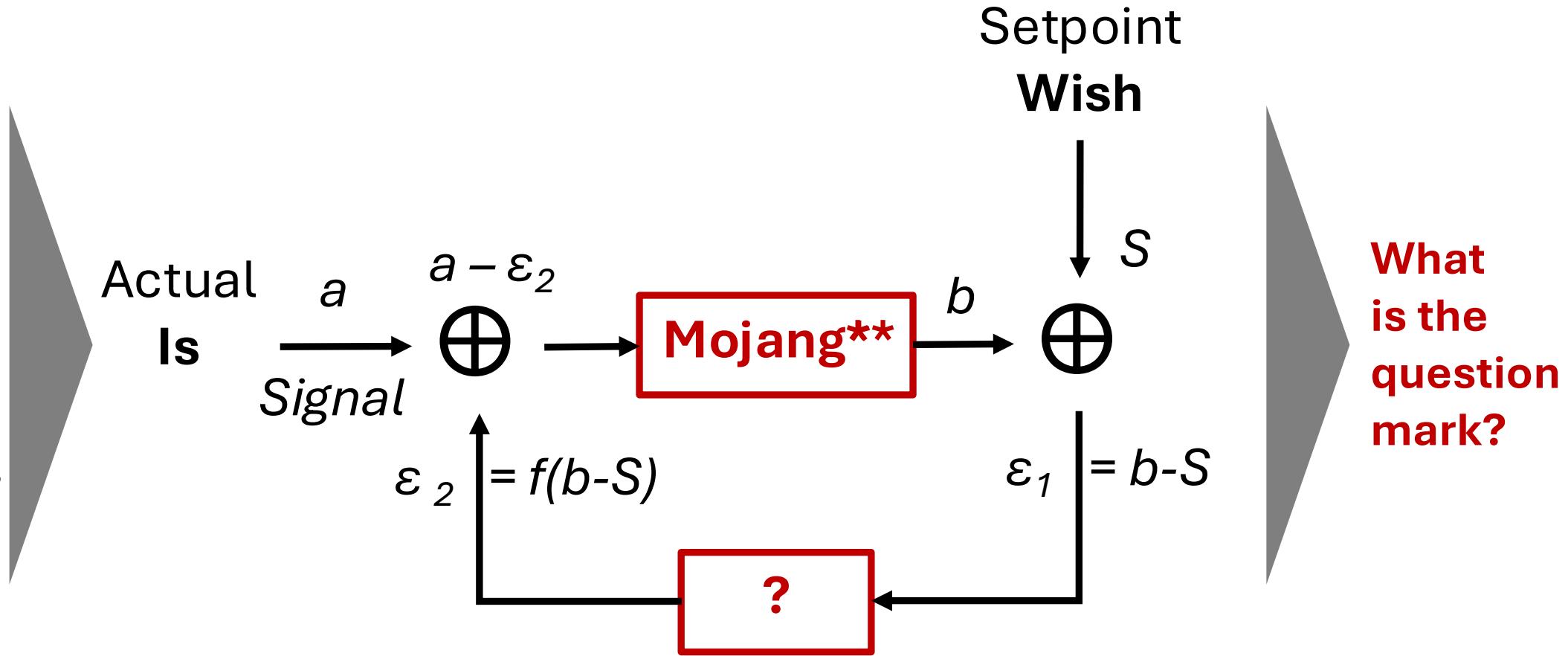
- **Where to find heat**
- **Where to eat safely**
- **How long is today's commute**
- **How much taxes will we raise**

But how do they happen?

The negative feedback loop (NFL) makes life possible

Control Theory*

- Human thought
- Stereo amplifiers
- AI & LLM



* See, e.g., [Simrock](#)

** Also known as **Plant**. Some apparatus (a brain, a brake...) that takes a and modifies into b

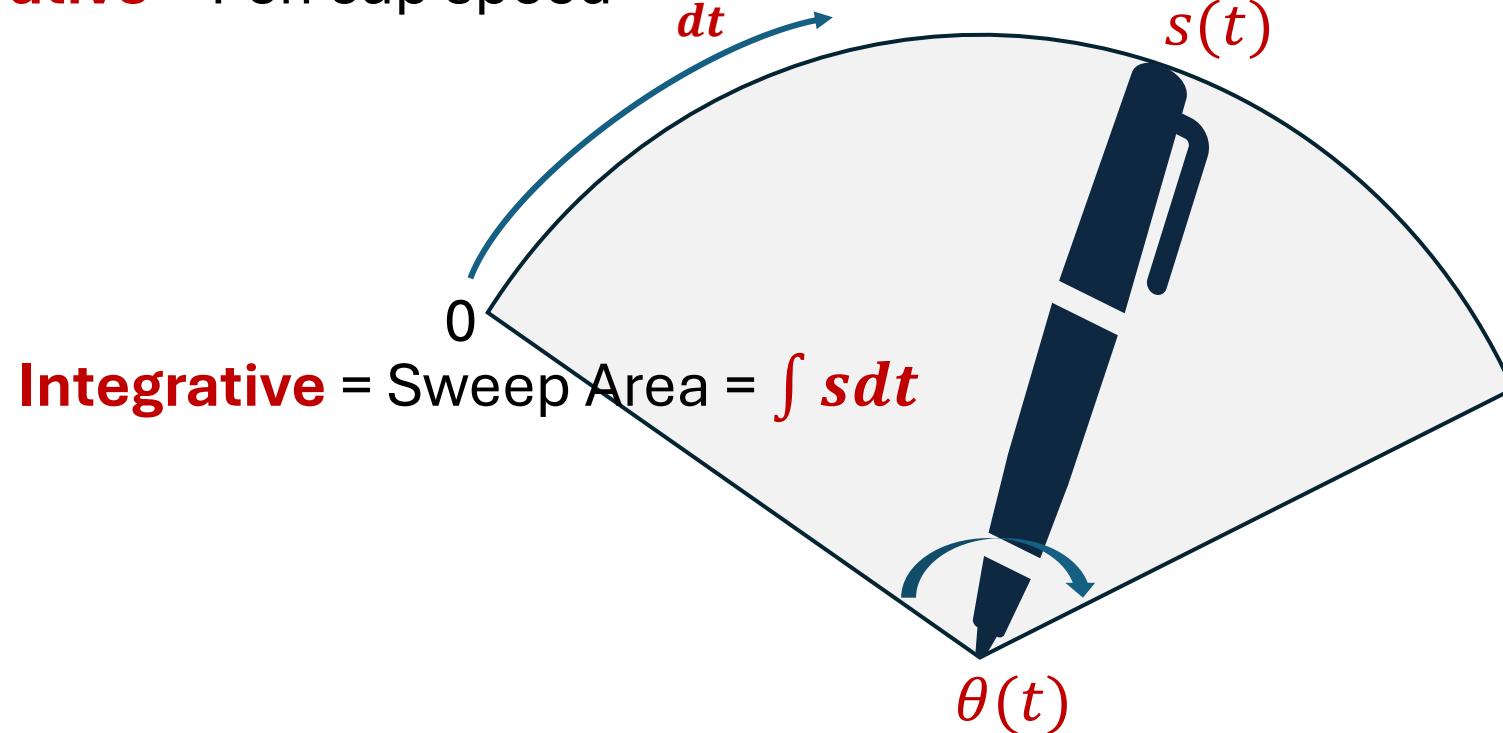
Demo

The ? is a P.I.D controller

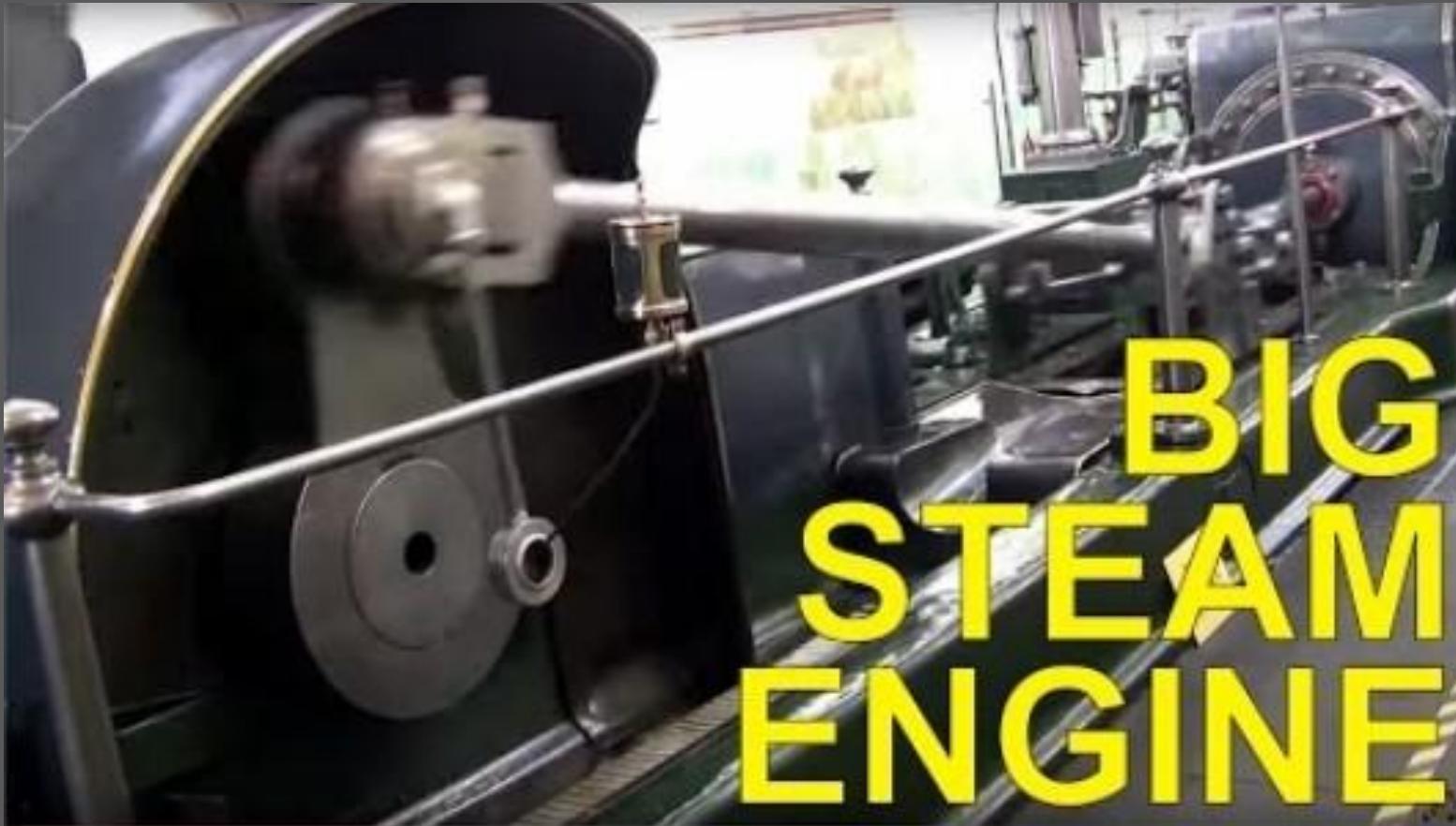
Example: Imagine a pen sweeping around the nib from left to right

Derivative = Pen cap speed = $\frac{ds}{dt}$

Proportional = Pen cap position = s

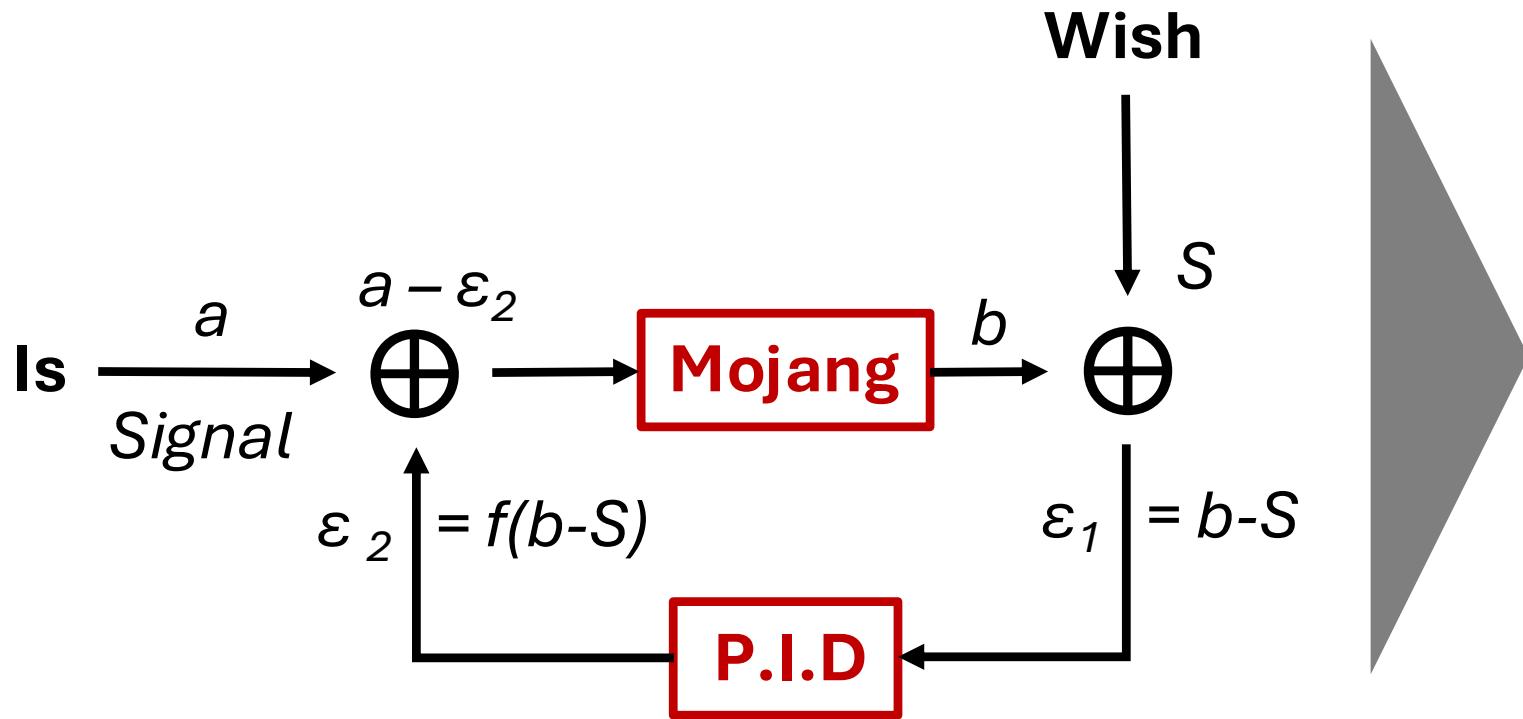


Shown like this to correspond to the live demonstration



Steam engine with P.I.D controller (the vertically rotating part seen at 49s)

Predictions are negative feedback loops governed by P.I.D controllers



1. Movements
2. Instincts
3. Reasoning
4. Consciousness

Similar to Backpropagation in AI

How does Tellusant use this?

- **Data harmonization**
 - They usually put in the data as-is without harmonizing between datasets. This is an **open loop** system without **NFL**
 - Tellusant makes sure the data is harmonized so the end point of the first data set matched beginning point of the second dataset. This is **NFL** with a P regulator
- **Short-term statistical models**
 - We, as everyone else, uses an NFL with P.I.D regulator
- **Long-term forecasting**
 - We use mainly a P regulator, but there are opportunities to work with P.I.D
- **Recession nowcasts**
 - Federal Reserve uses NFL with P
 - Our innovation is NFL with P.I.D

We will increasingly use the NFL / P.I.D logic in most things we do.