# Thinking, About Time

No comma here!

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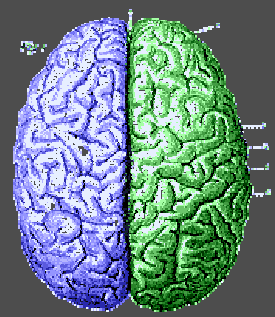
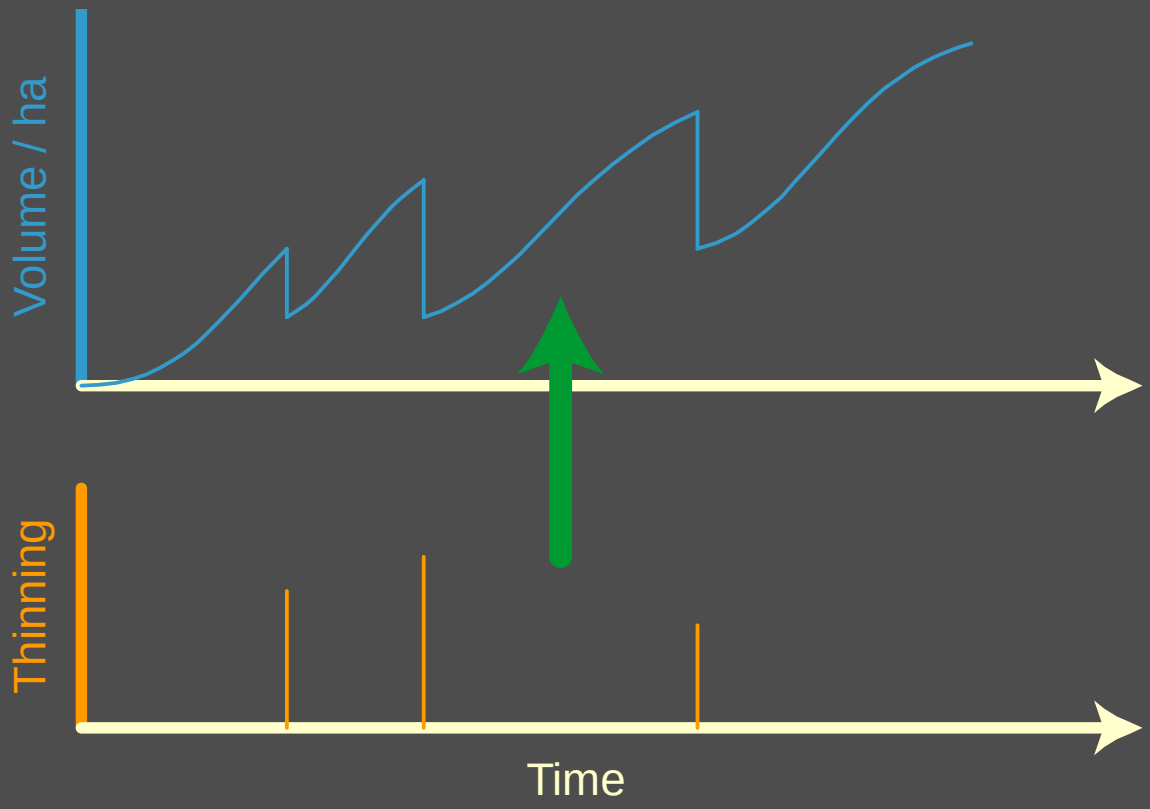
# Introduction / Outline

- Time
  - In general
  - In forestry
- Process representation (modelling)
- Rates  (Newton)
- System Theory  (1960’s)
- Aha!



# Example

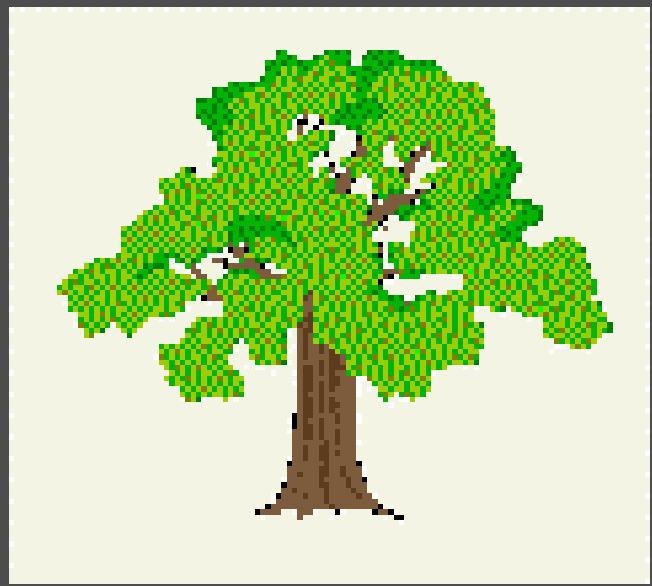



# Example

DBH, height

↑

Temperature

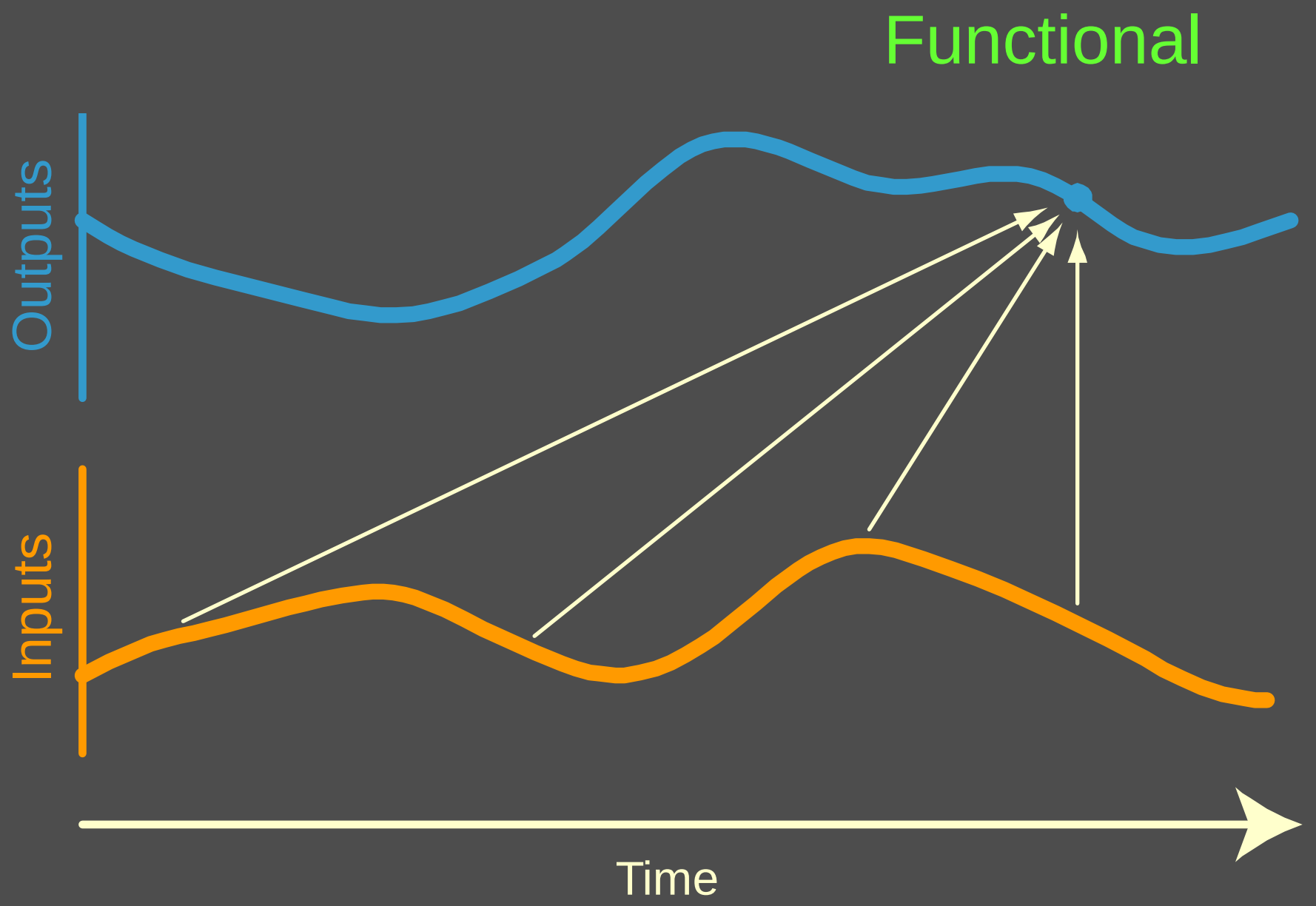


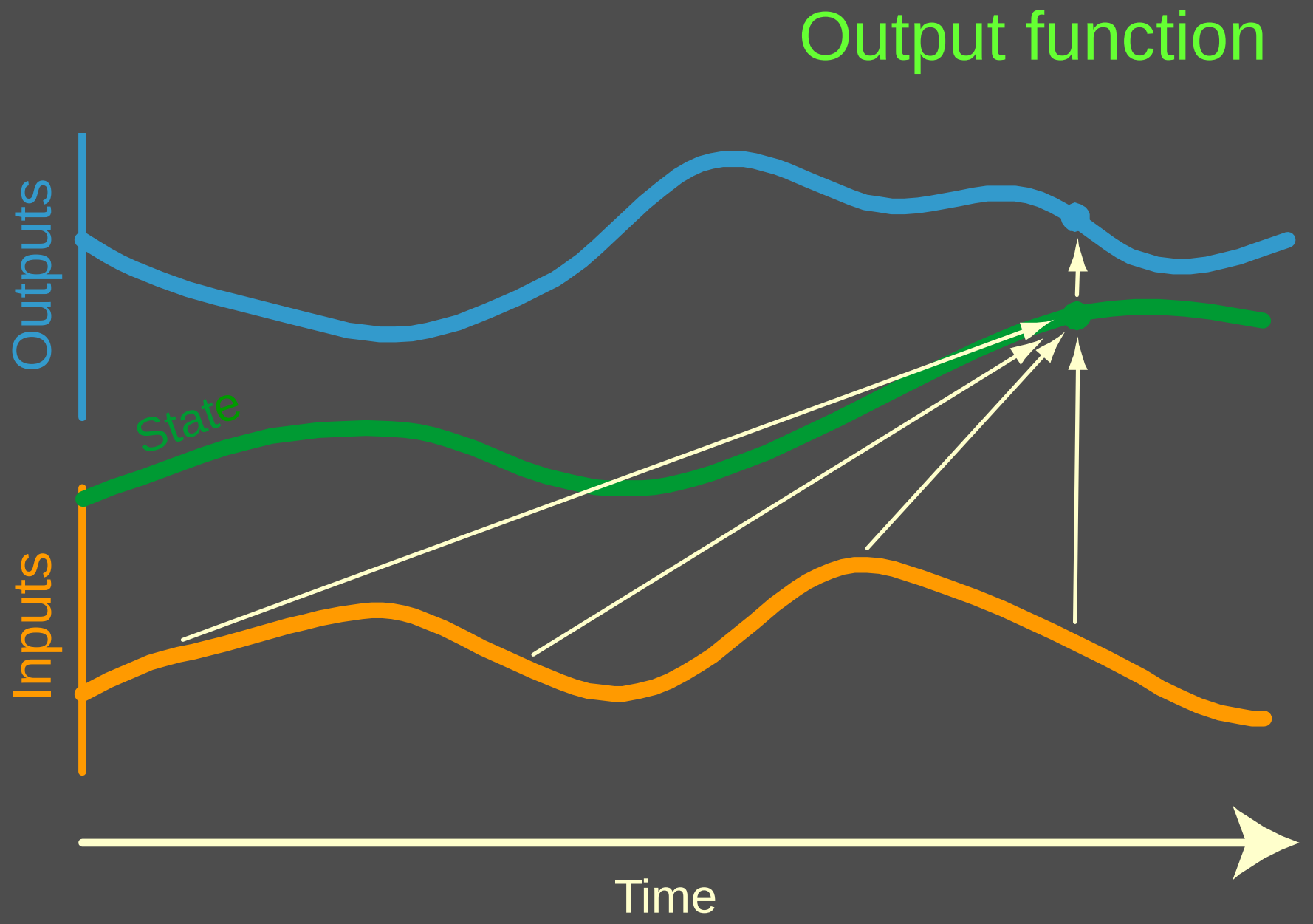
# Example

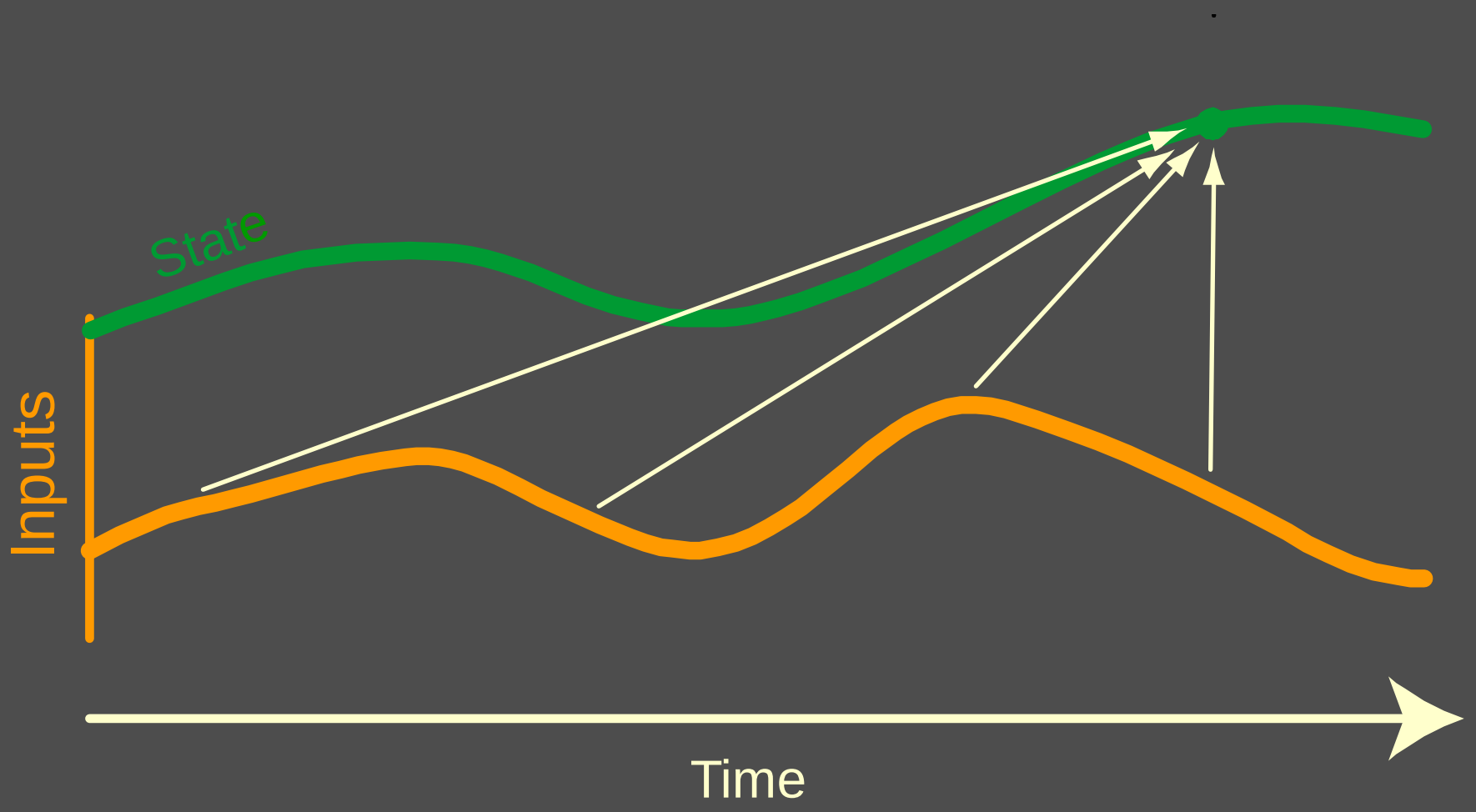
Supply

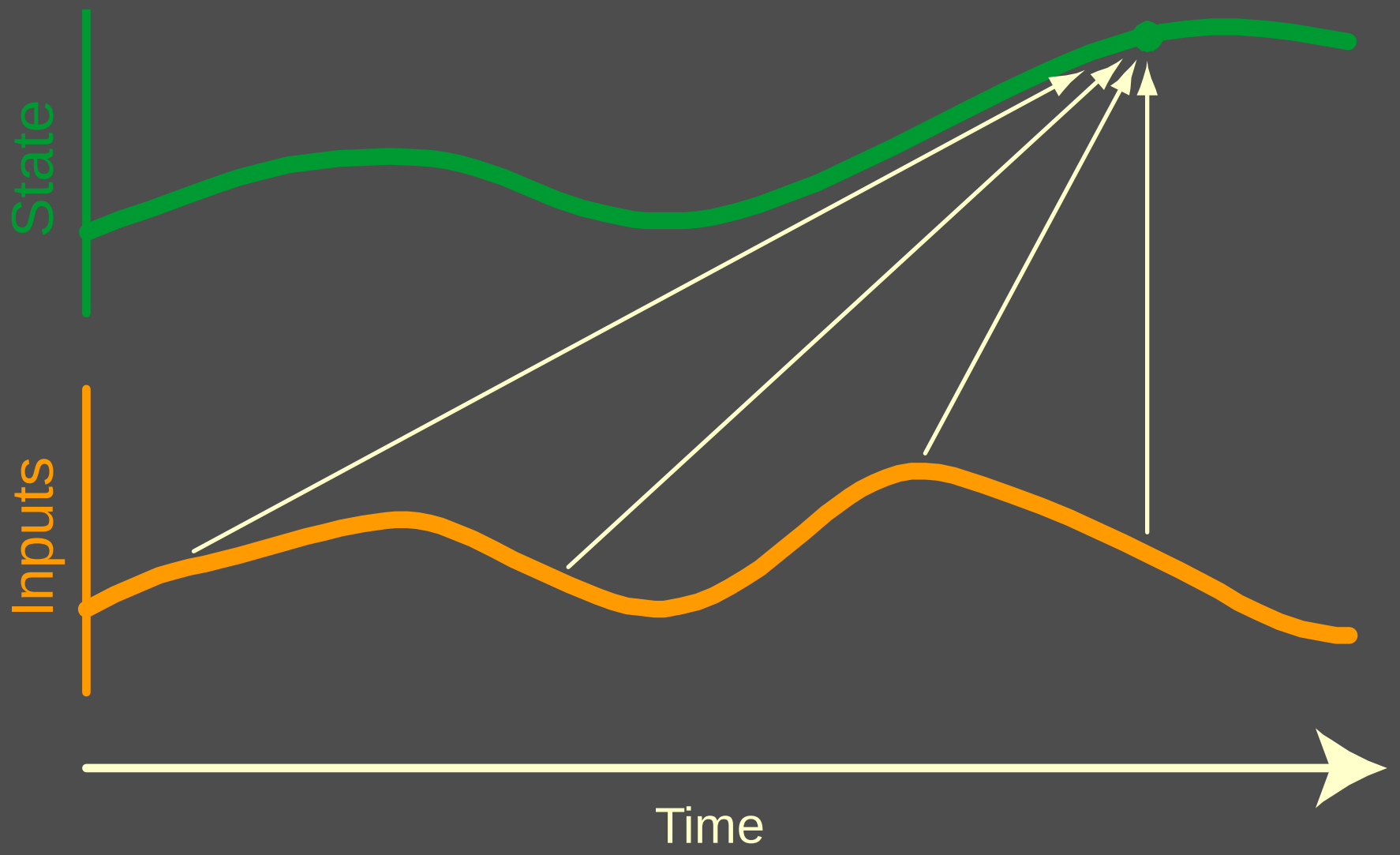
↑

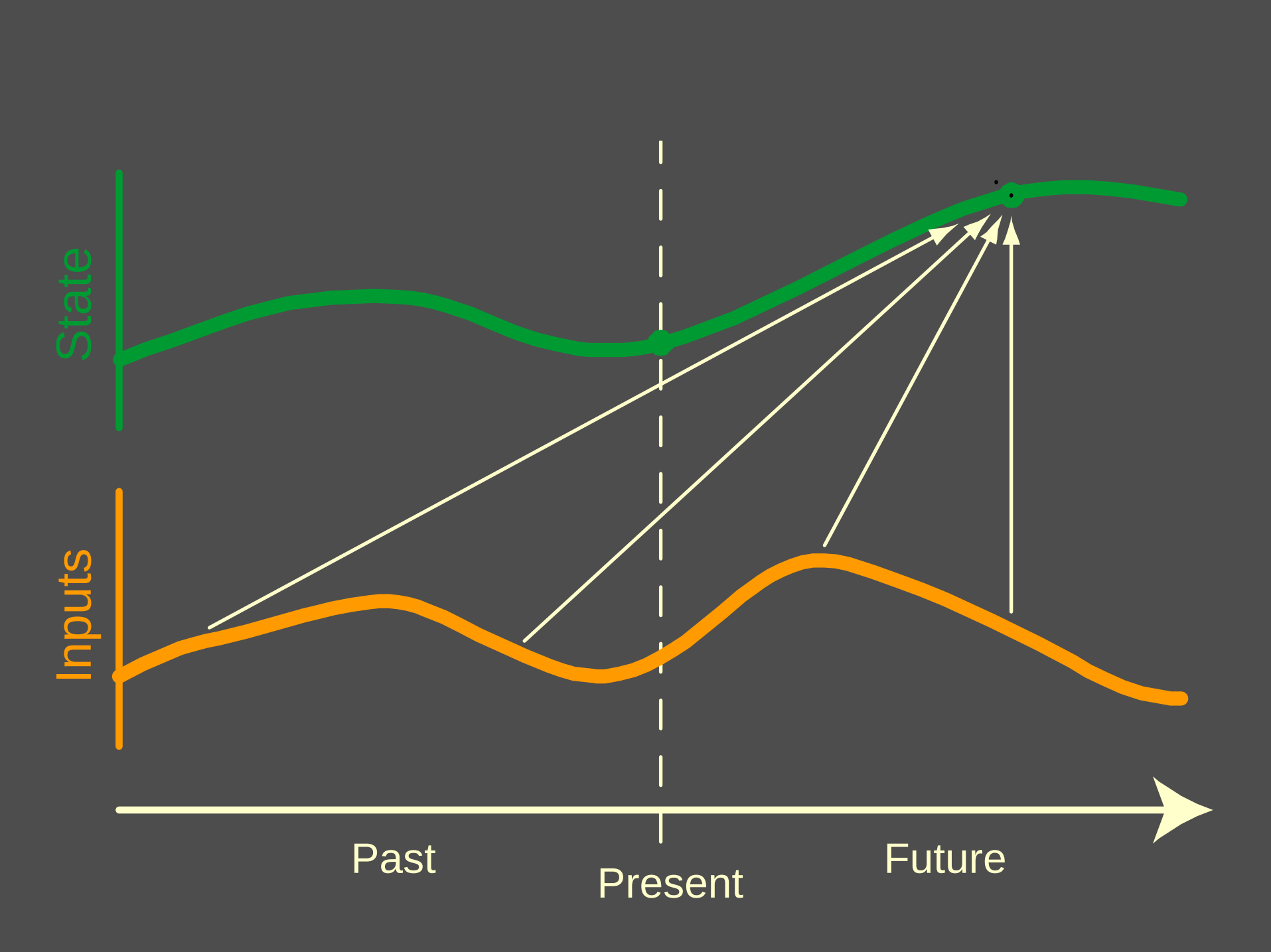
Harvest

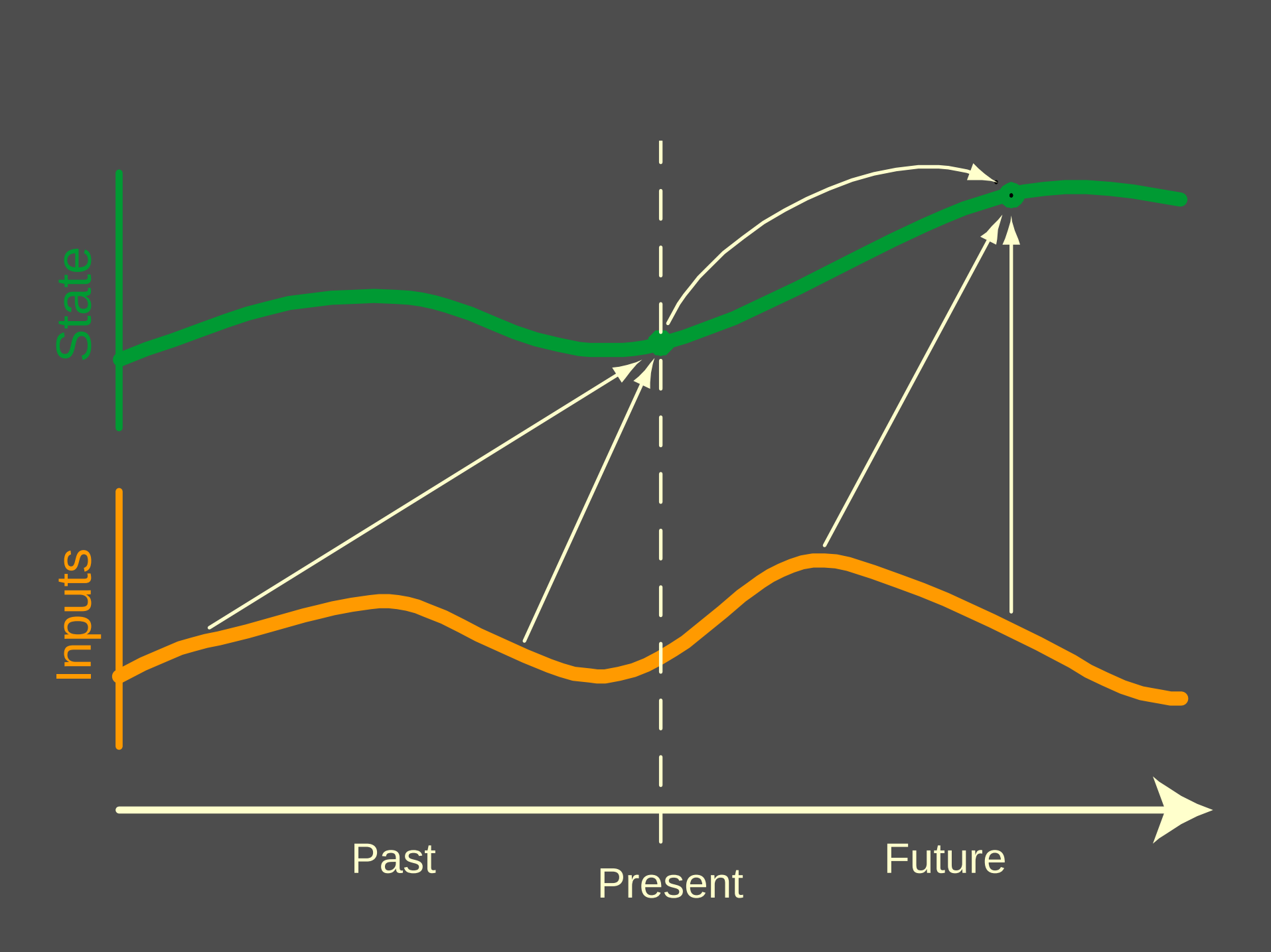

Functional
Outputs
Inputs
Time


Output function
Outputs
State
Inputs
Time

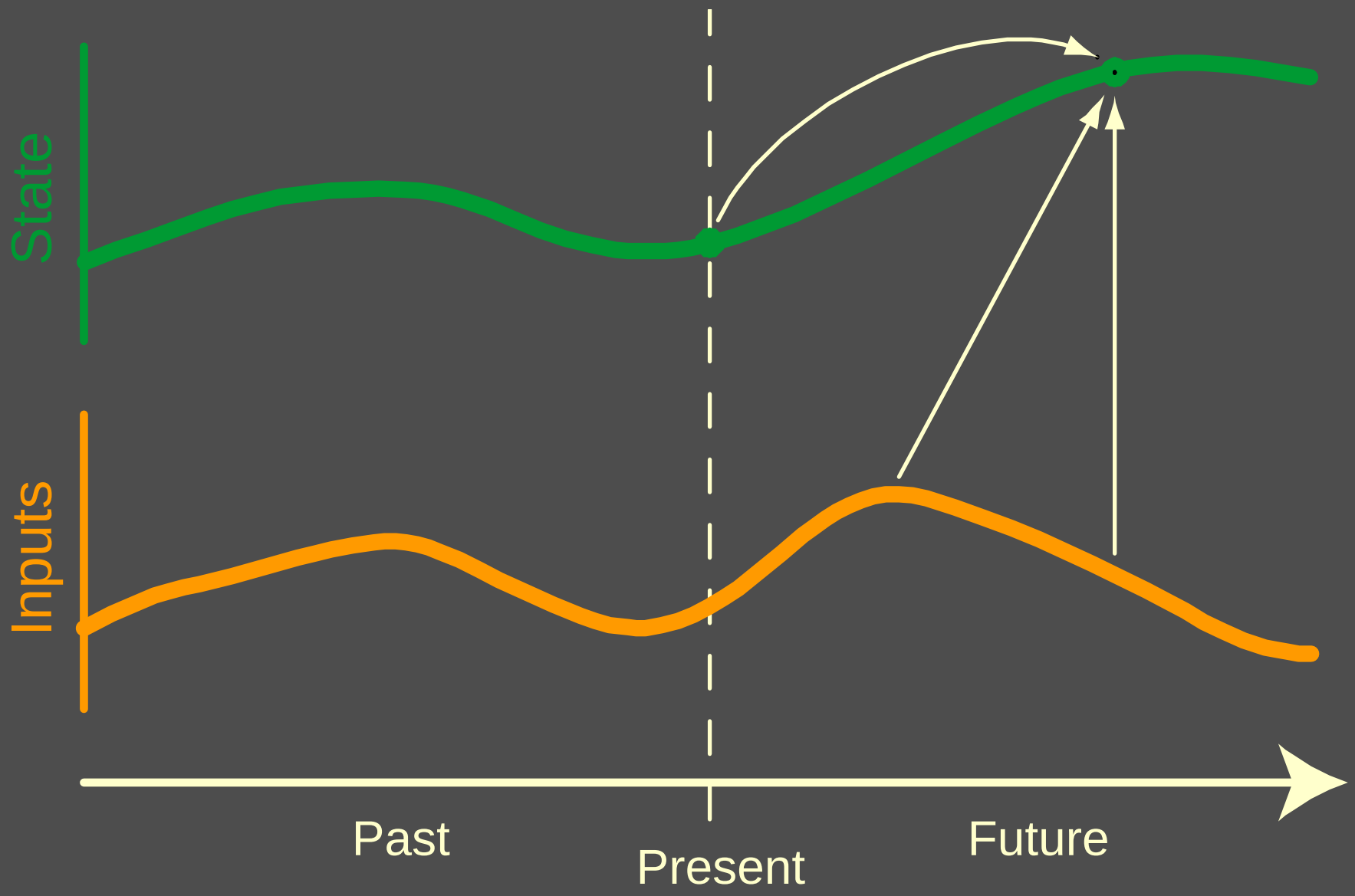

State
Inputs
Time

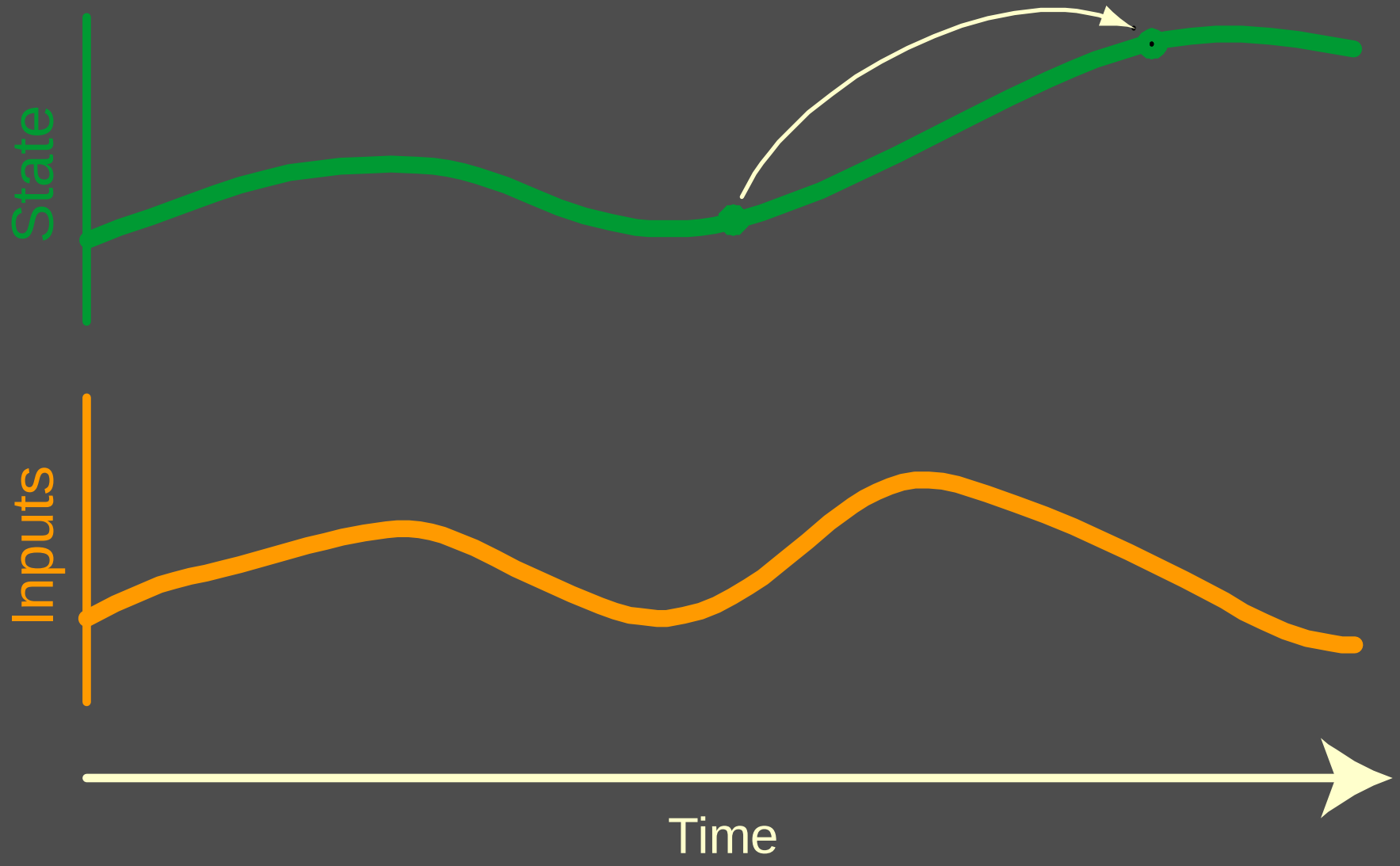

State
Inputs
Time

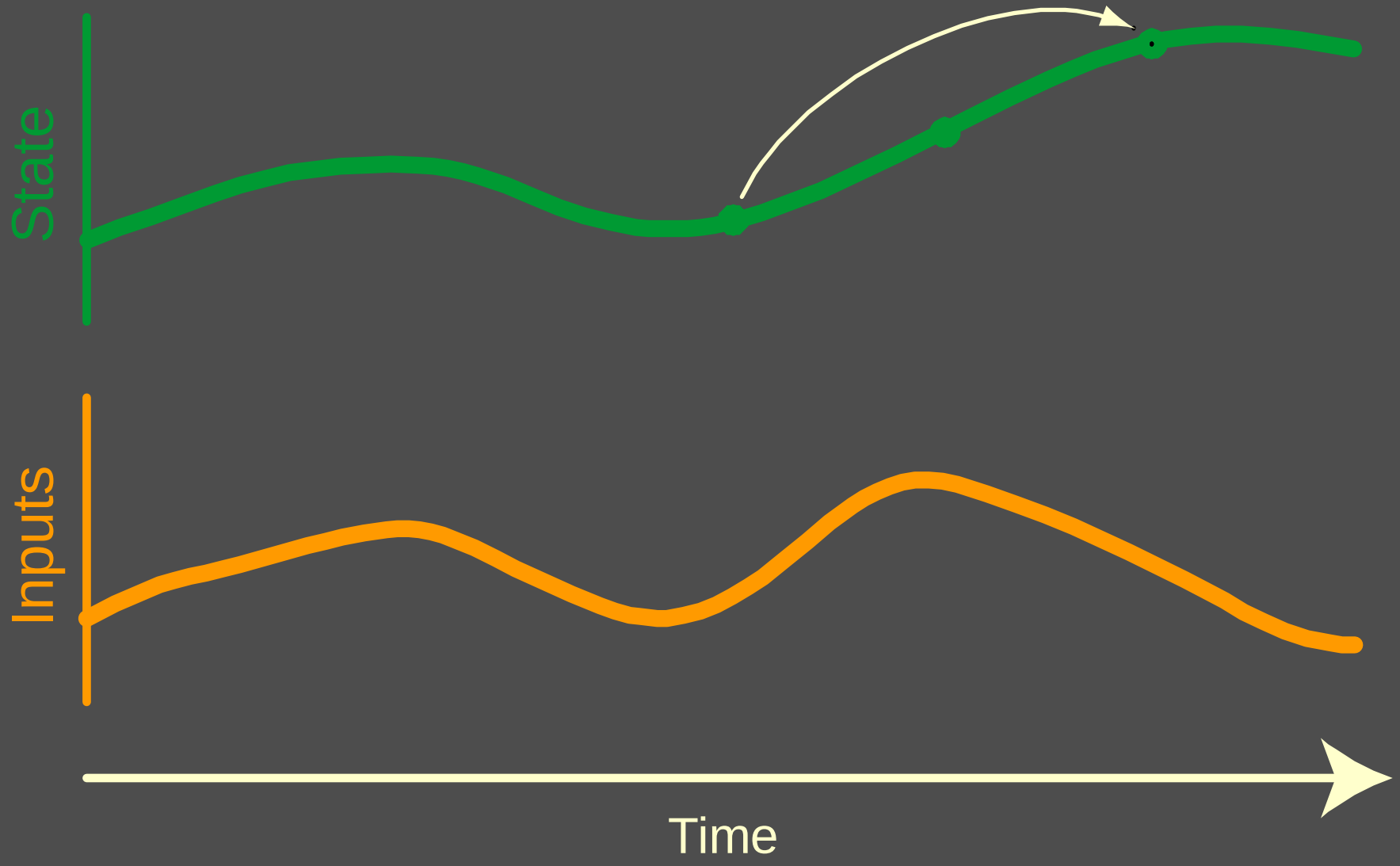

State
Inputs
Past
Present
Future

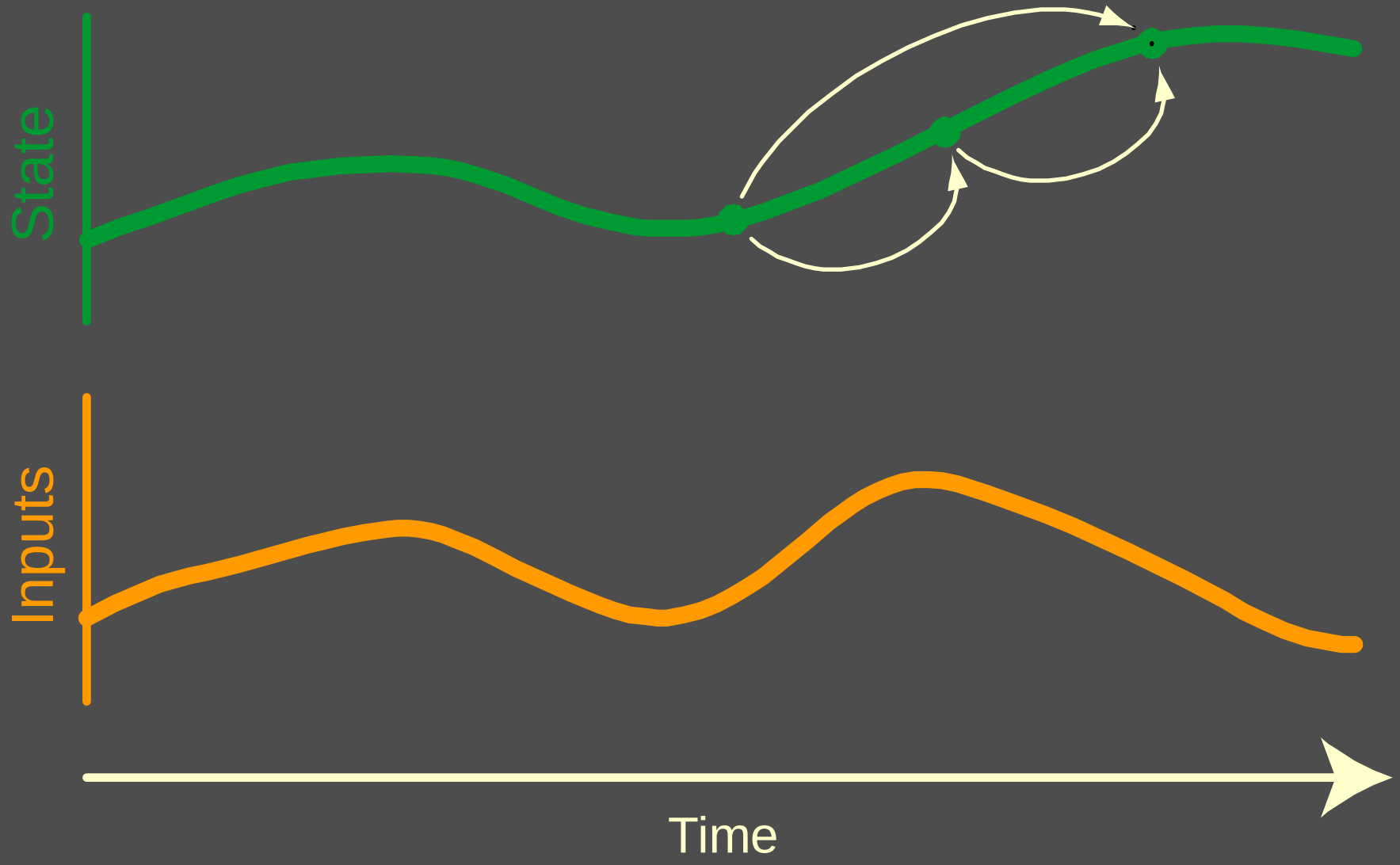

State
Inputs
Past
Present
Future

# Transition function (global)

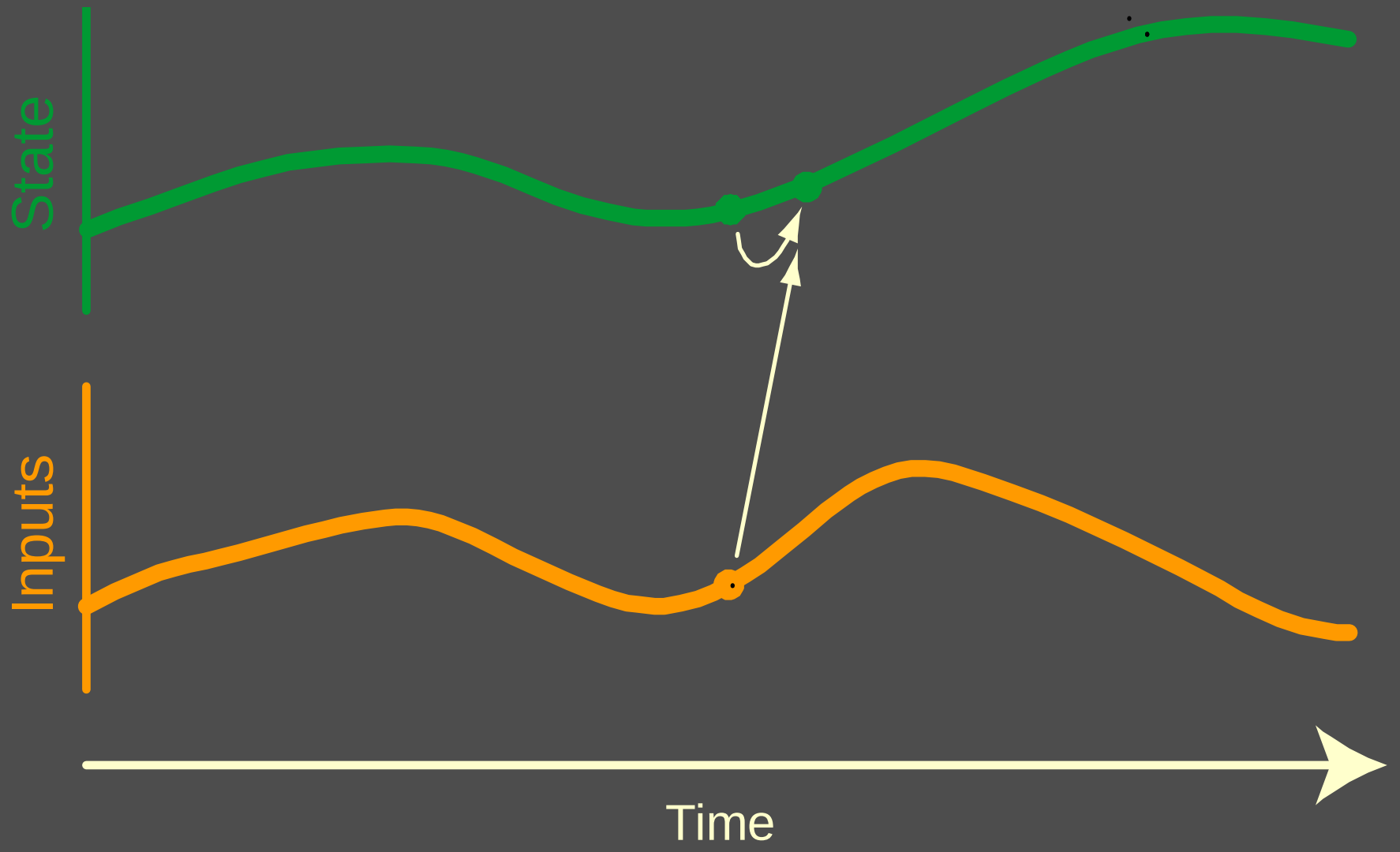


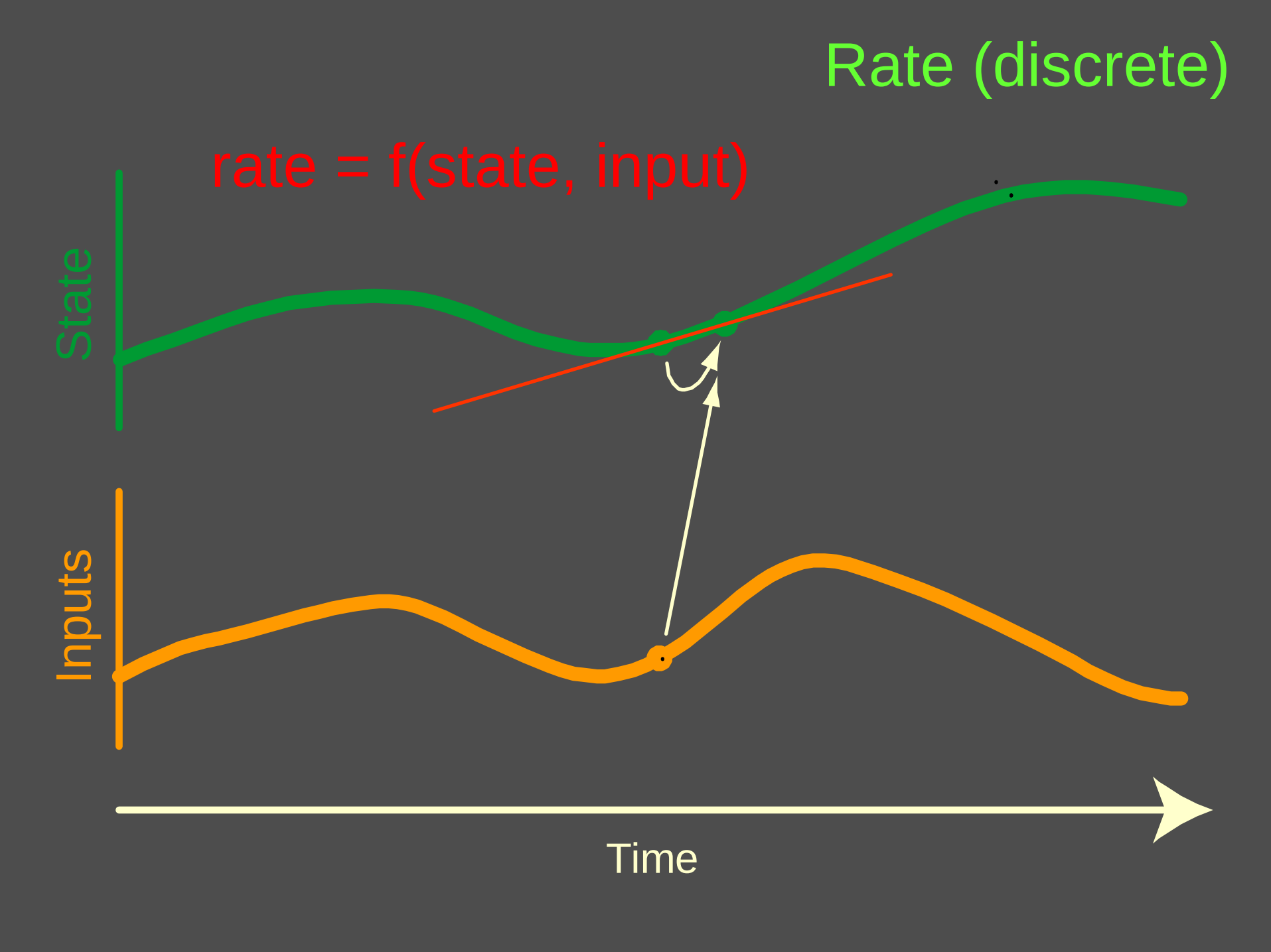

State
Inputs
Time


State
Inputs
Time

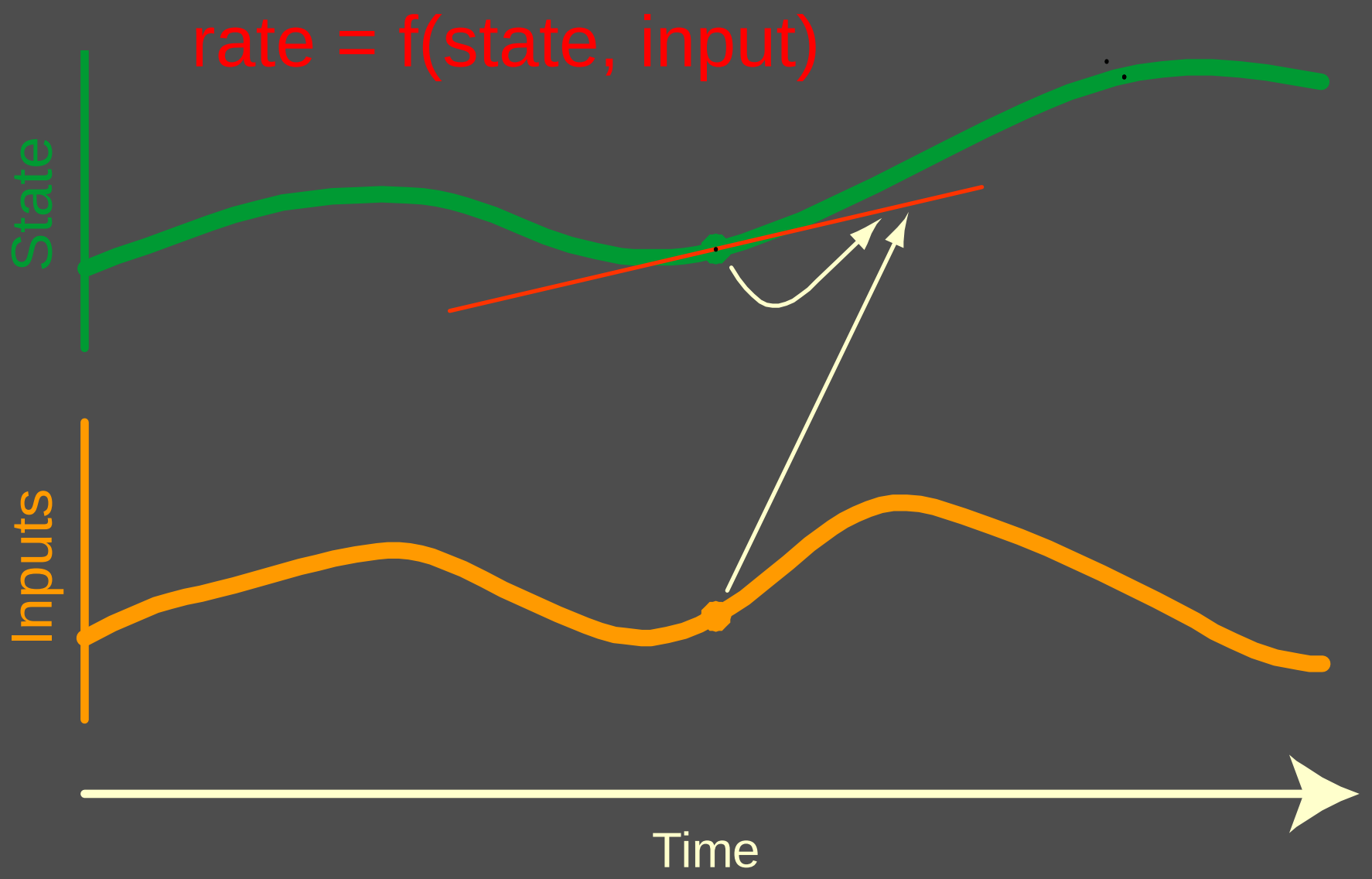

State
Inputs
Time

# Local transition function



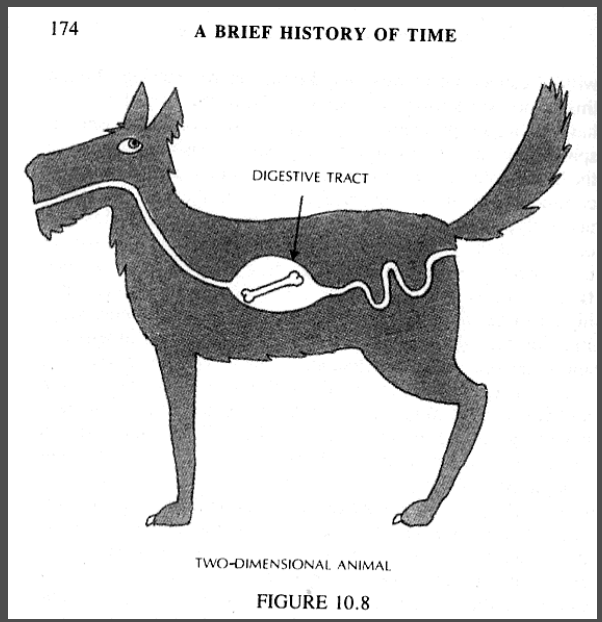

Rate (discrete)
rate = f(state, input)
State
Inputs
Time

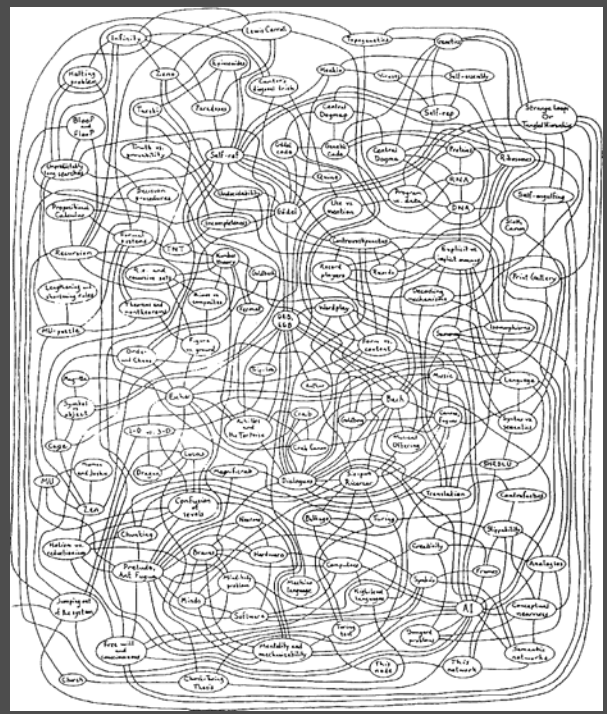
# Rate (continuous)



# Scale

- State detail, level, resolution
- E.g., growth models:  distance-dependent, distance-independent, whole-stand
- Extremes?



# Scale

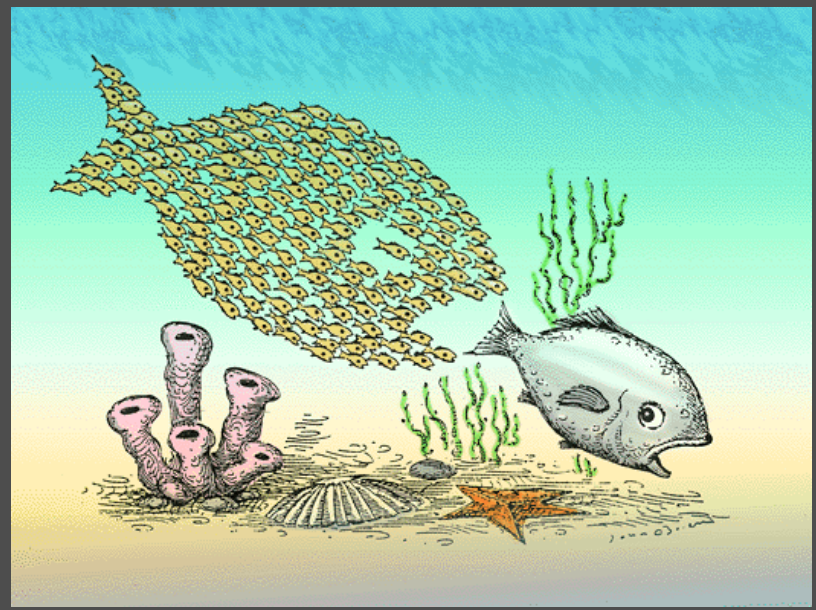
- Descriptive models (research, understanding)
- Predictive models (decision-making)
  - Einstein-García principle ☺:

"Use as few state variables as possible, but not less"


Utsunomiya, 17/10/04

# Scale

- Linking different levels
  - “The purpose of computing is insight, not numbers”  (Hamming)
  - Emergent properties



  - Generalized Statistical Mechanics?

# Conclusions

- Rates
- Aha?
- Obvious!