CSE 440:
Introduction to HCI

02: Design Language & Inclusive Design 101

March 28, 2024

Jesse J. Martinez | Avery Mack | Simona Liao

Jesse Checklist

- Zoom: Speeding
  - Host: TA'd
  - Slides: Shared WITH AUDIO
  - Recording: Yes
- Panopto: Live & Recording
- Ed: Q&A'd
- Mic: on
- Slides: projected
- Captions: Captioning

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Course Reminders

Assignment 0 (Intro Slide) Due tonight @ 8pm

Assignment 1a (Project Brainstorm) Due tonight @ 8pm

Keep an eye out for people looking for groupmates

Keep an eye out for email re: final section assignments

- Trying to make as few changes as possible
- If you expressed you can only be in your currently assigned section, that IS the section you will be in

Section Tomorrow:

- Be on time – MGH 058, 12:30 for Section C, 1:30 for Section D
- Have your 1a submission readily available (physically or digitally)

If Canvas doesn't work, email us your submissions!

Overview

- Some Design Language
  - An End-to-End Design Process
  - The Gulfs of Execution & Evaluation
  - Intro to Tasks
  - Mental Models
  - Affordances
- Inclusive Design (and how people fail at it)
  - Design Tradeoffs & Value-Sensitive Design
  - Can One Size *Really* Fit All?

Objectives

Be able to:

Describe the different phases of the Design Process
(in progress)

Describe the Execution-Evaluation Cycle and understand how to use it to anticipate design failures

Describe Task-Based Design, articulate user Tasks, and apply tasks to different phases of the Design Process
(in progress)

Define Mental, Implementation, and Manifest Models, their relationships, and how they are created

Describe and identify examples of affordances, including false and hidden affordances

Objectives

Be able to:

Identify design tradeoffs between designs and assess which design is “best” for a certain context

Describe Value-Sensitive Design, the role values play in design, and how to mitigate designer bias
(in progress)

Overview

Some Design Language

- An End-to-End Design Process
- The Gulfs of Execution & Evaluation
- Intro to Tasks
- Mental Models
- Affordances

Inclusive Design (and how people fail at it)

- Design Tradeoffs & Value-Sensitive Design
- Can One Size *Really* Fit All?

An End-to-End Design Process

As told by IDEO (in 1999)

IDEO's Deep Dive (ABC News, 1999)

http://courses.cs.washington.edu/courses/cse440/videos/design/IDEO-DeepDive.mp4

ABC News and IDEO's Deep Dive

Things to see in this video:

- brainstorming
- design research
- sketching
- critique

Why build a shopping cart with no bottom?

A highly iterative design process
with a variety of intermediate artifacts

IDEO's Deep Dive (ABC News, 1999)

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Is this the Perfect Shopping Cart?

Perfect Shopping Cart?

Perfect Shopping Cart?

Several design flaws

- Kids will slide and fall out of that seat
- Where to put bags of dog food, cases of beer?
- Hook design with reusable bags
- Self-scanning challenges with theft

Focus on the design process

- Designs always have limitations and tradeoffs
- *(More on this later…)*

Perfect Shopping Cart?

Several design flaws

- Kids will slide and fall out of that seat
- Where to put bags of dog food, cases of beer?
- Hook design with reusable bags
- Self-scanning challenges with theft

Focus on the design process

- Designs always have limitations and tradeoffs
- *(More on this later…)*

Some limitations in the process you saw?

The Design Process

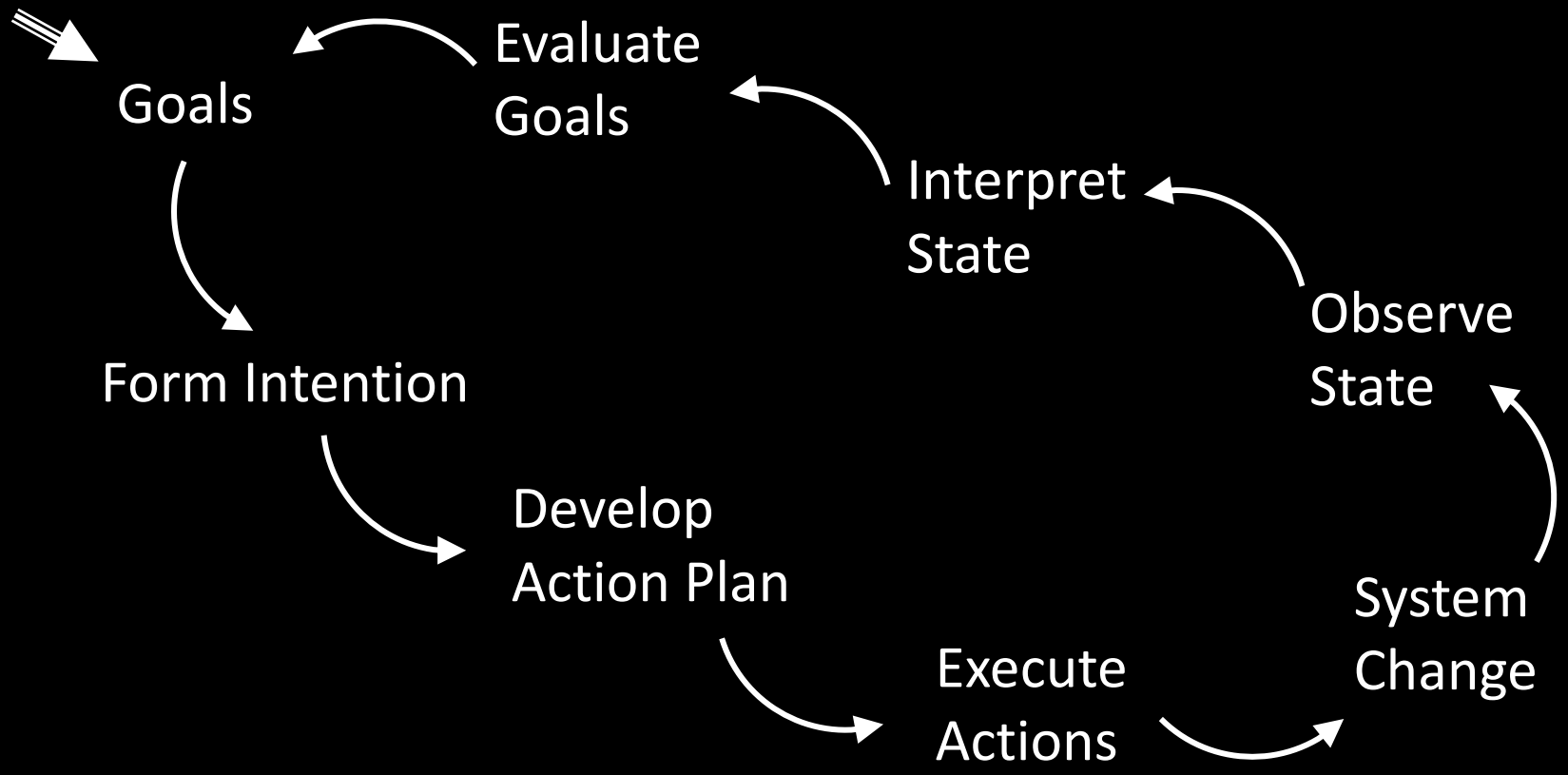
0. *Find a Problem*
1. Brainstorming
2. Design Research
3. Sketching (+ Critique)
4. Prototyping (+ Critique)
5. *Usability Testing*

Design Language 101

Goal:

Be able to look at existing designs and understand how they fail / exclude users

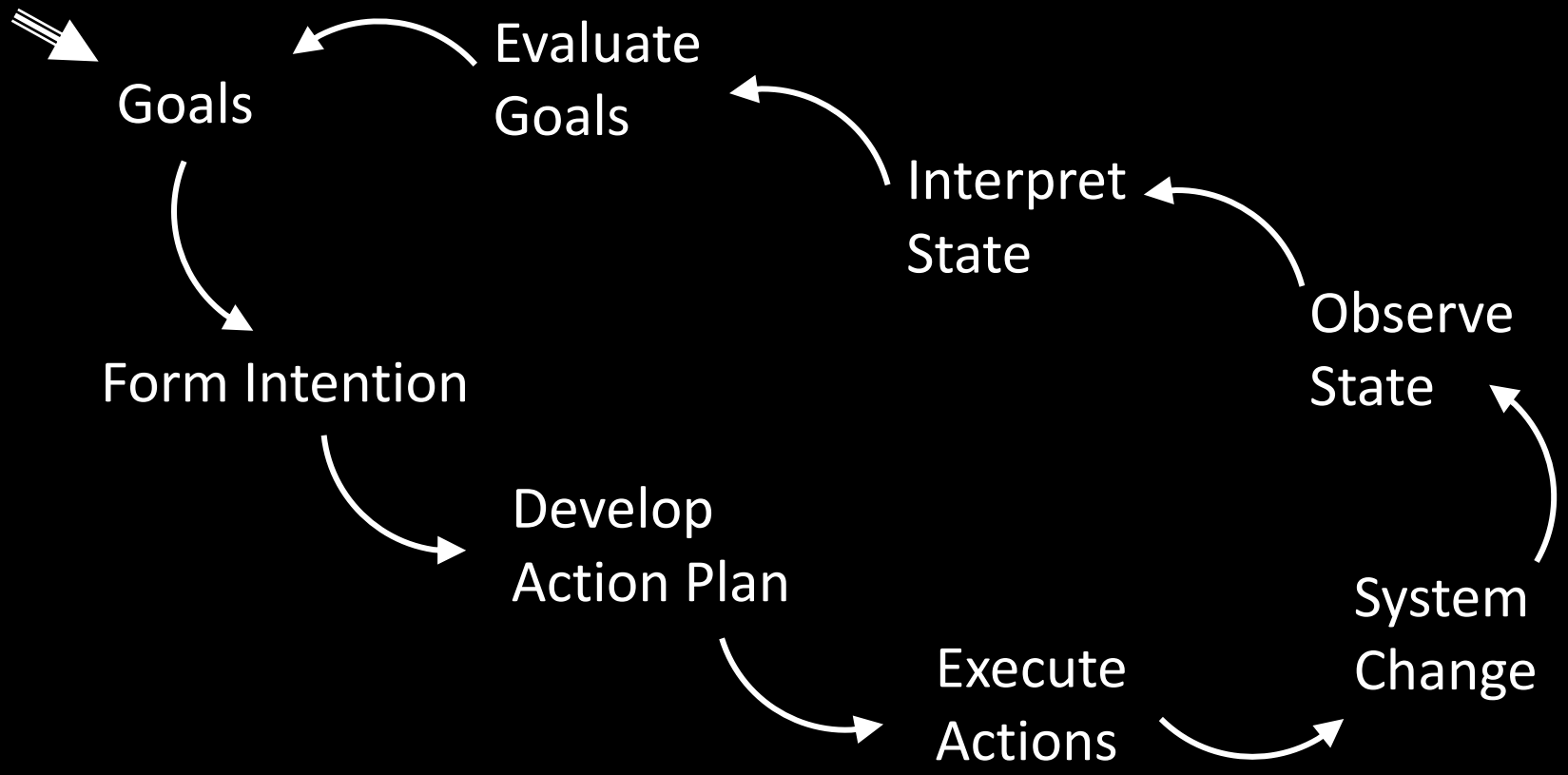
Norman's Execution-Evaluation Cycle



Turning on the Light

1. Establish the goal
   Increase light in the room
2. Form the intention
   To turn on the lamp
3. Specify the action sequence
   Walk to the lamp, reach for the knob, twist the knob
4. Execute the action sequence
   [walk, reach, twist]
5. Perceive the system state
   [hear “click” sound, see light from lamp]
6. Interpret the system state
   The knob rotated. The lamp is emitting light. The lamp seems to work
7. Evaluate the system state with respect to the goals and intentions
   The lamp did indeed increase the light in the room [goal satisfied]

Norman's Execution-Evaluation Cycle



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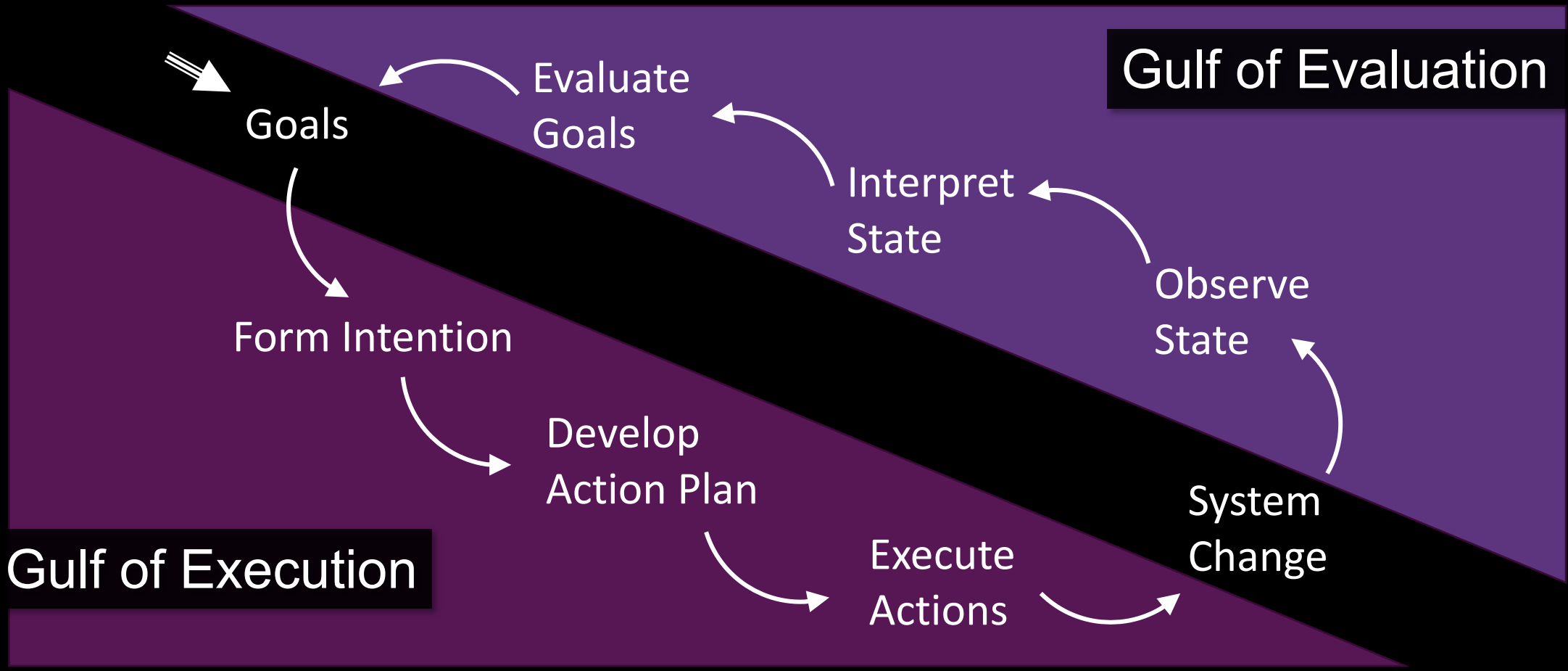

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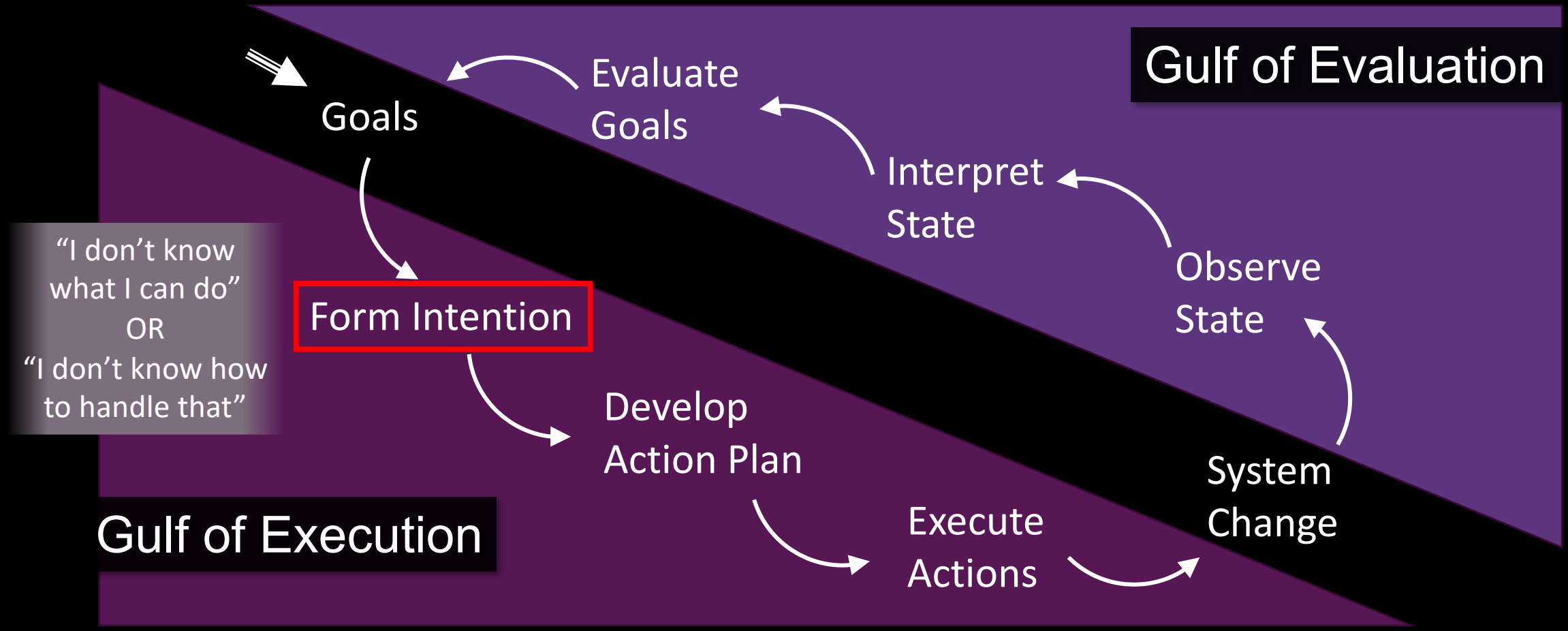

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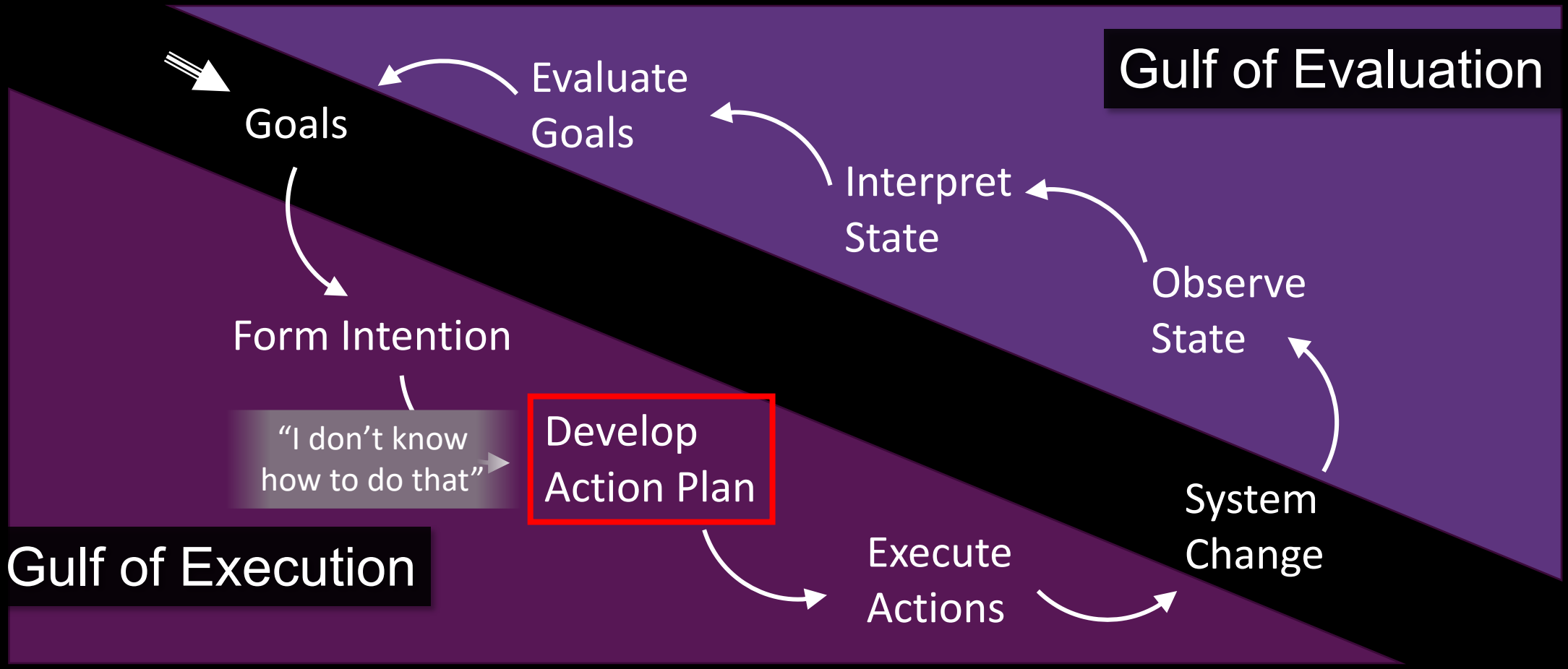

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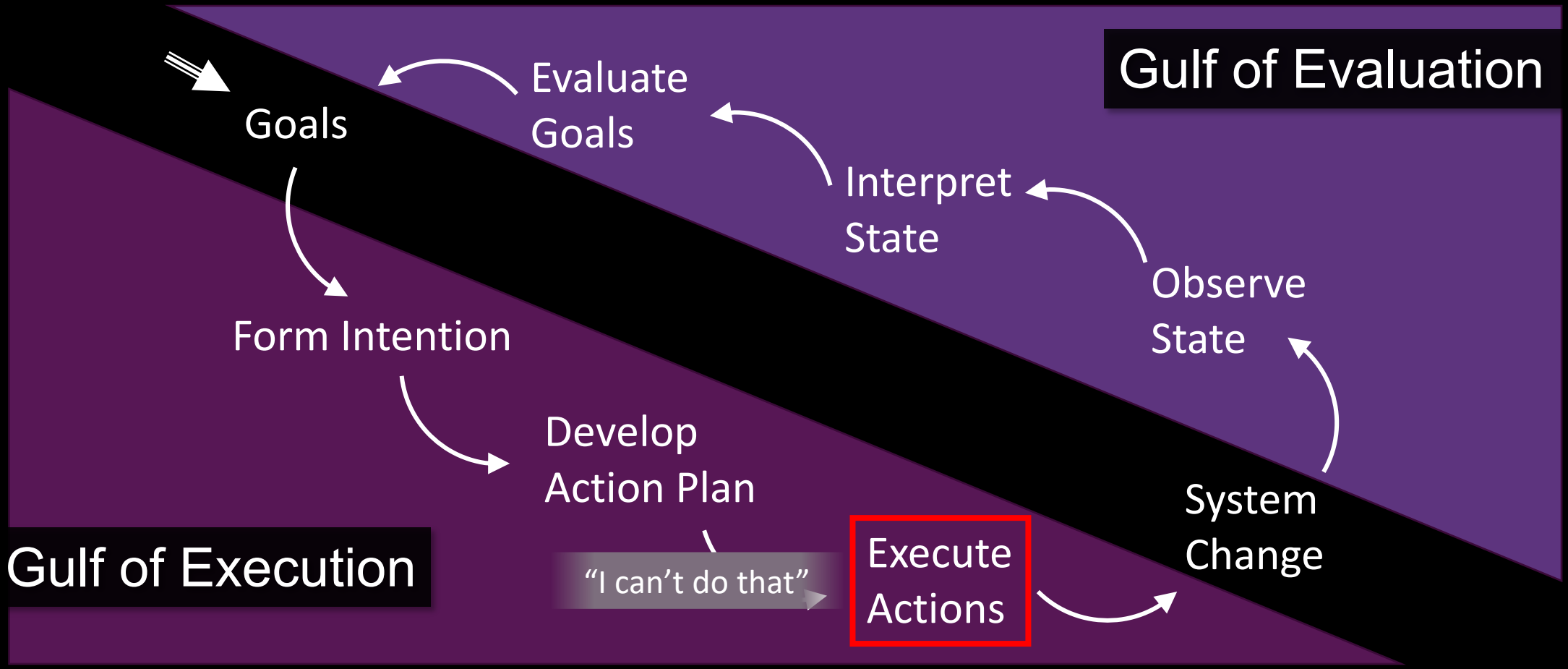

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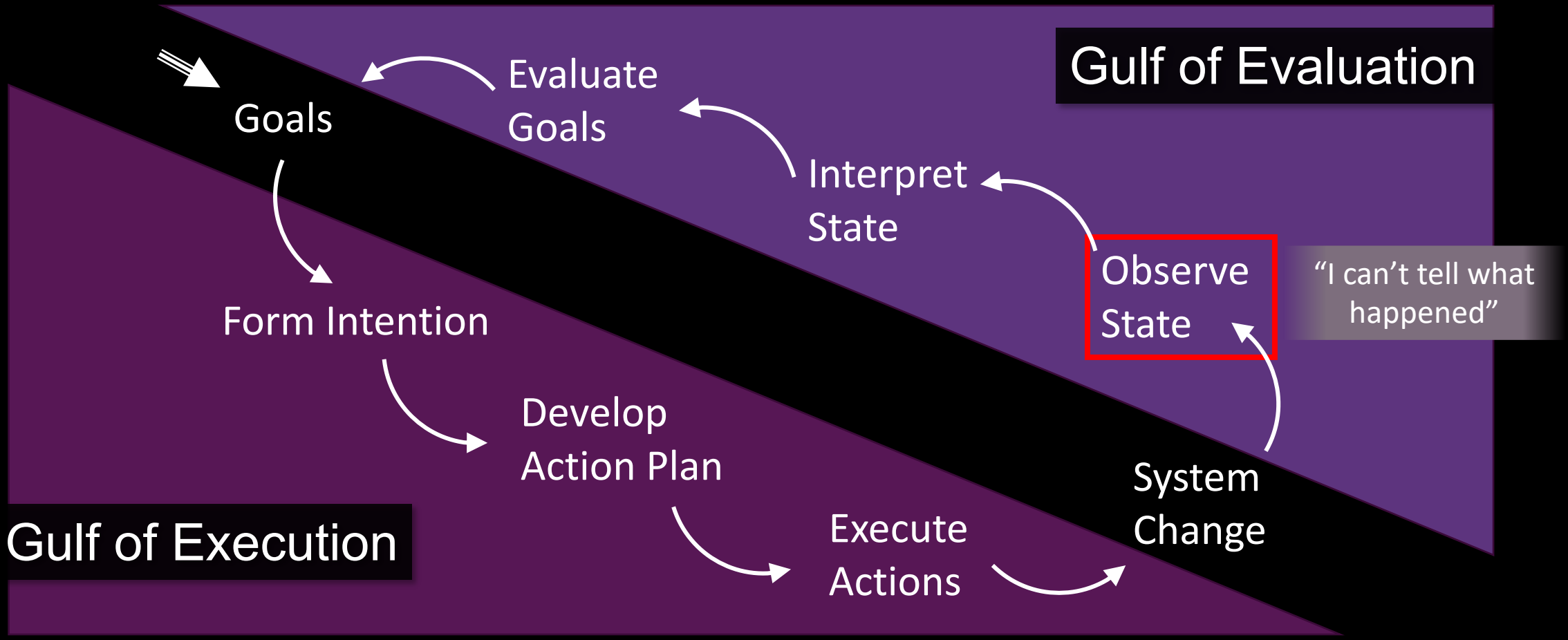

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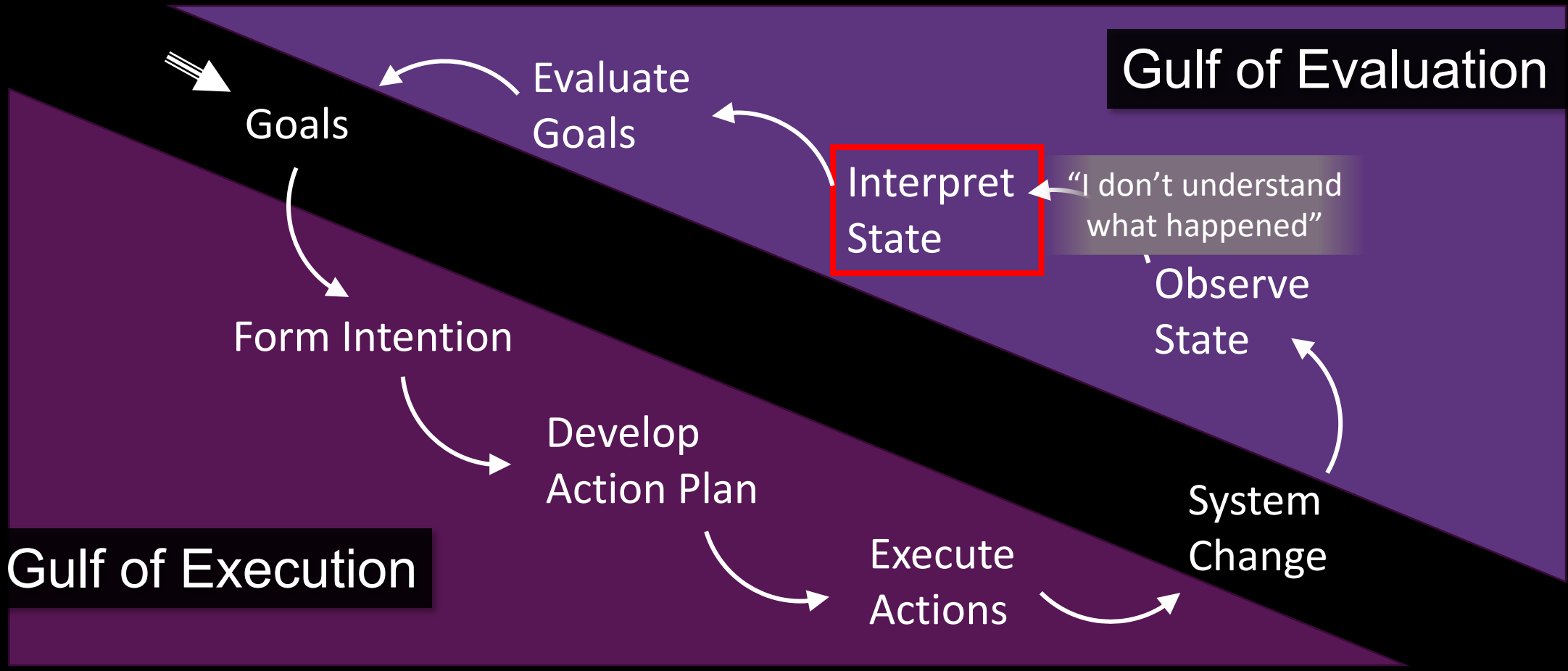

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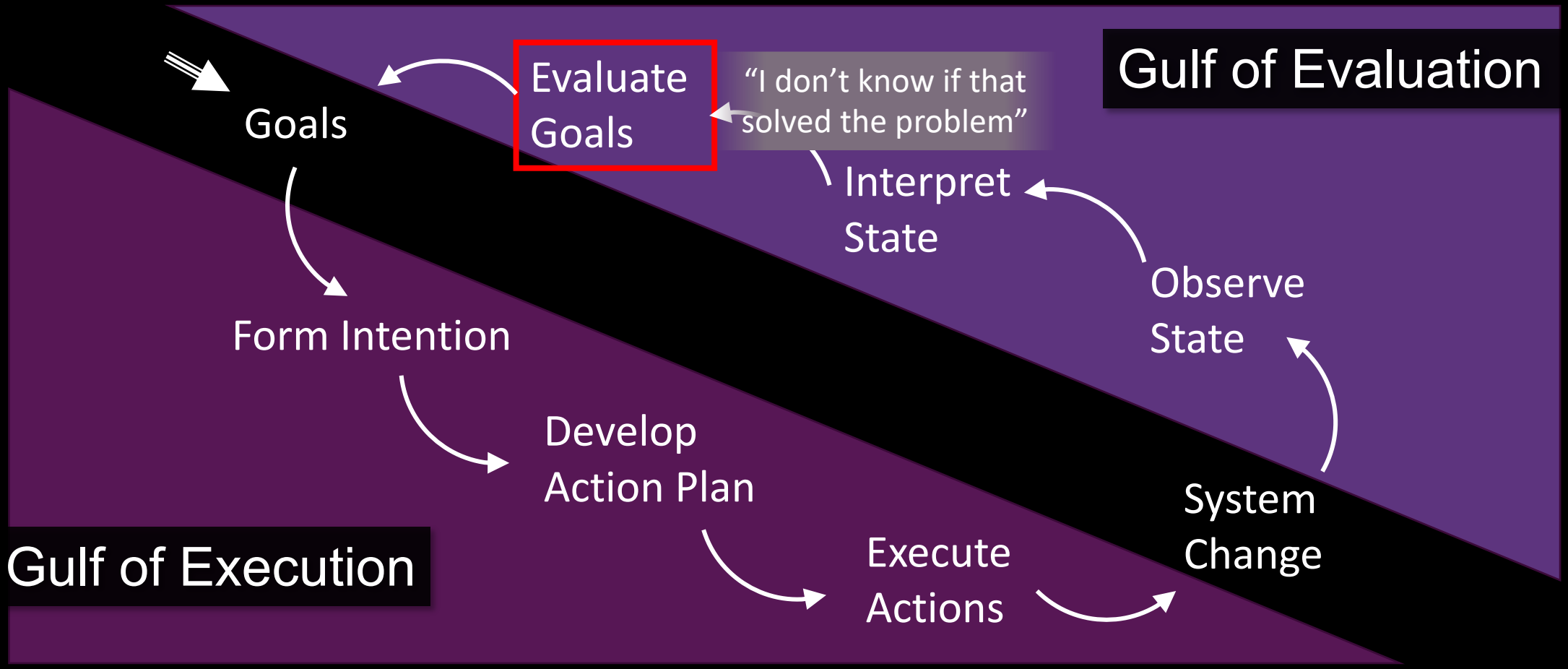

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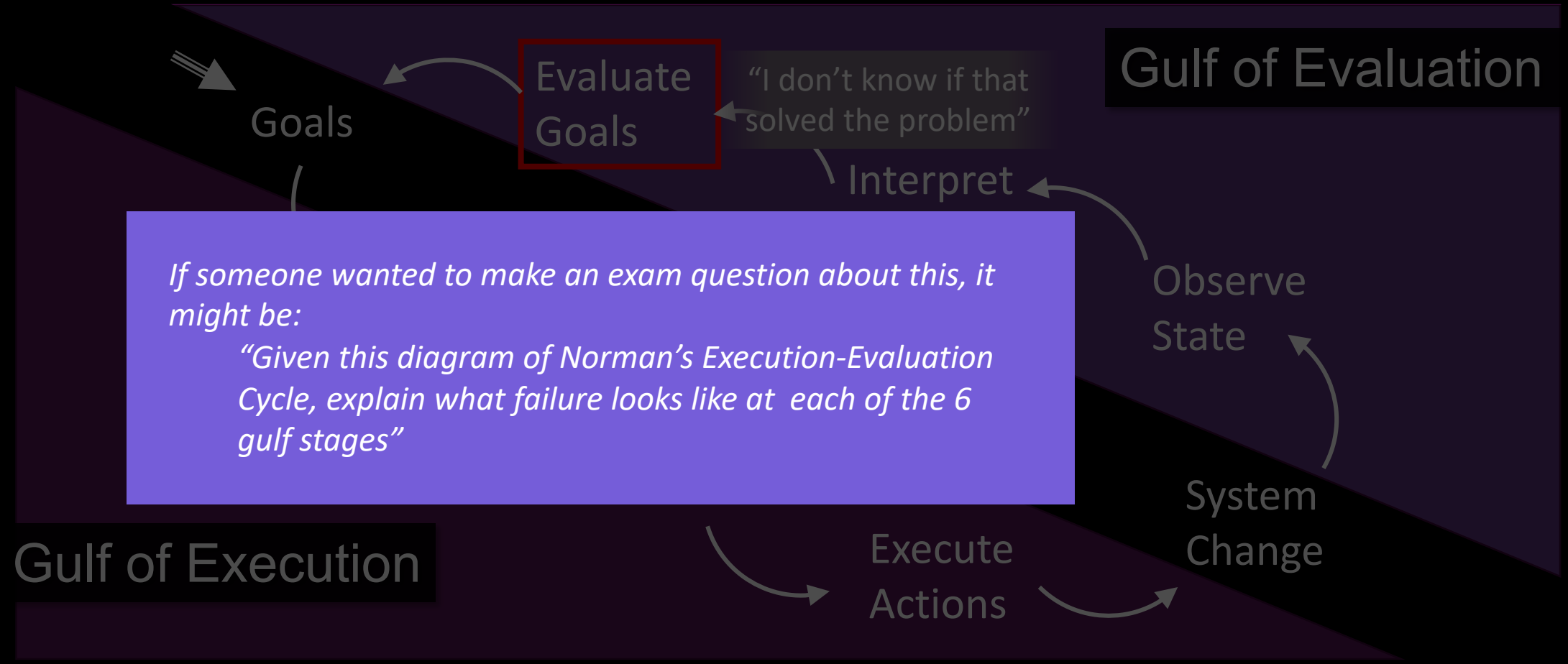

Bridging the Gulfs

Gulf of Execution: "How do I do it?"

Commands and mechanisms need to match the goals, thoughts, and expectations of a person

Gulf of Evaluation: "What does it mean?"

Output needs to present a view of the system that is readily perceived, interpreted, and evaluated

Tasks are a useful model for understanding and describing what people are trying to do

Intro to Task-Based Design

A **Task** represents something that a user is trying to accomplish

A task can be:

Based on a Long- or Short-term Goal

Long-term goal: Brad wants to get in shape by working out more
Related Tasks: "Track physical fitness progression"
"Schedule more workouts"

Short-term goal: Nina wants to go see a movie right now
Related Tasks: "Find nearby theaters"
"Learn what movies are playing"

More on this as we move through the design process…

Intro to Task-Based Design

A **Task** represents something that a user is trying to accomplish

A task can be:

Oriented around an outcome in any part of the System

Goal: Be able to read in a dark room

Related Tasks: "Increase the light in the room"
"Find the book on a smartphone with a lit screen"
"Acquire night-vision"

More on this as we move through the design process…

Intro to Task-Based Design

A **Task** represents something that a user is trying to accomplish

A task can be:

Composed of Other Tasks

Long-term goal: Increase the light in the room

Subtasks: "Determine if opening the curtains would fix this"
"Learn if there are lamps in the room"
"Turn on a lamp"

More on this as we move through the design process…

Bridging the Gulfs

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People build **mental models** to anticipate and interpret system response to their actions

What can I do?	How do I do it?
What result will it have?	What is it telling me?

Cooper's Mental Model Terminology

Implementation Model

- How it works
- (Design Model, Designer's Conceptual Model)

Manifest Model

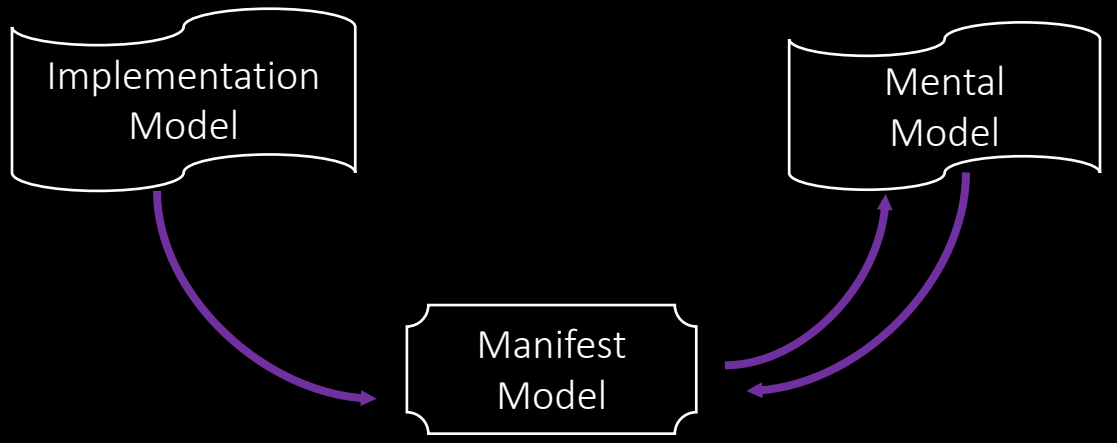
- How it presents itself
- (System Image)

Mental Model

- How a person thinks it works
- (User Model, User's Conceptual Model)

These terms are sloppy and ambiguous out in the world

Manifest and Mental Models



Designer projects their model into an artifact

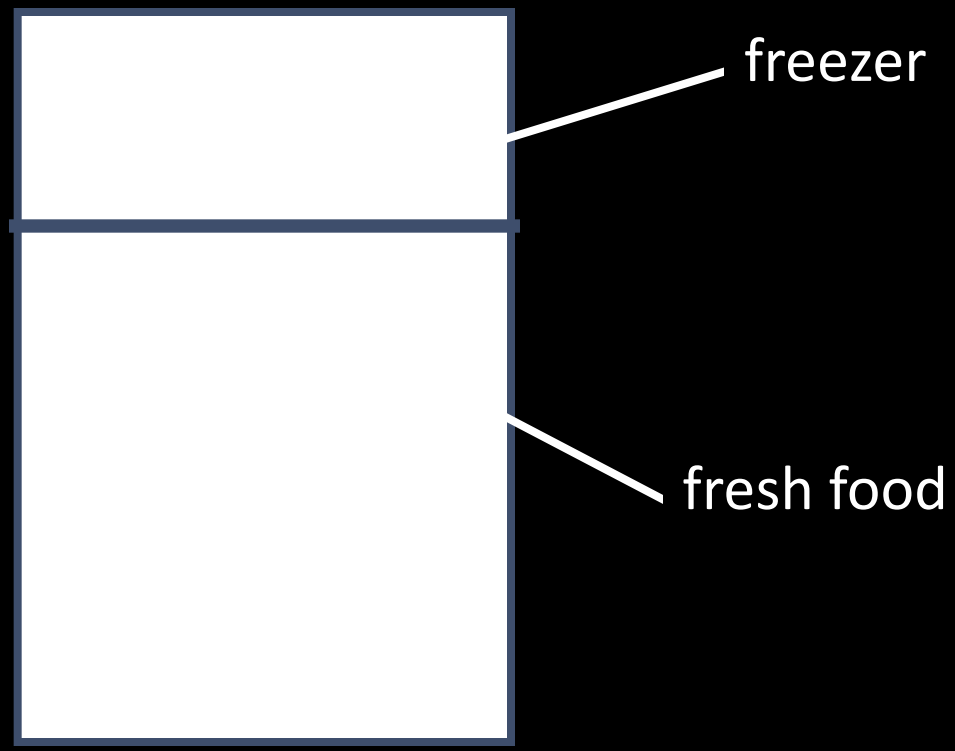
- Person forms their model based on interaction

People struggle until model matches manifest model

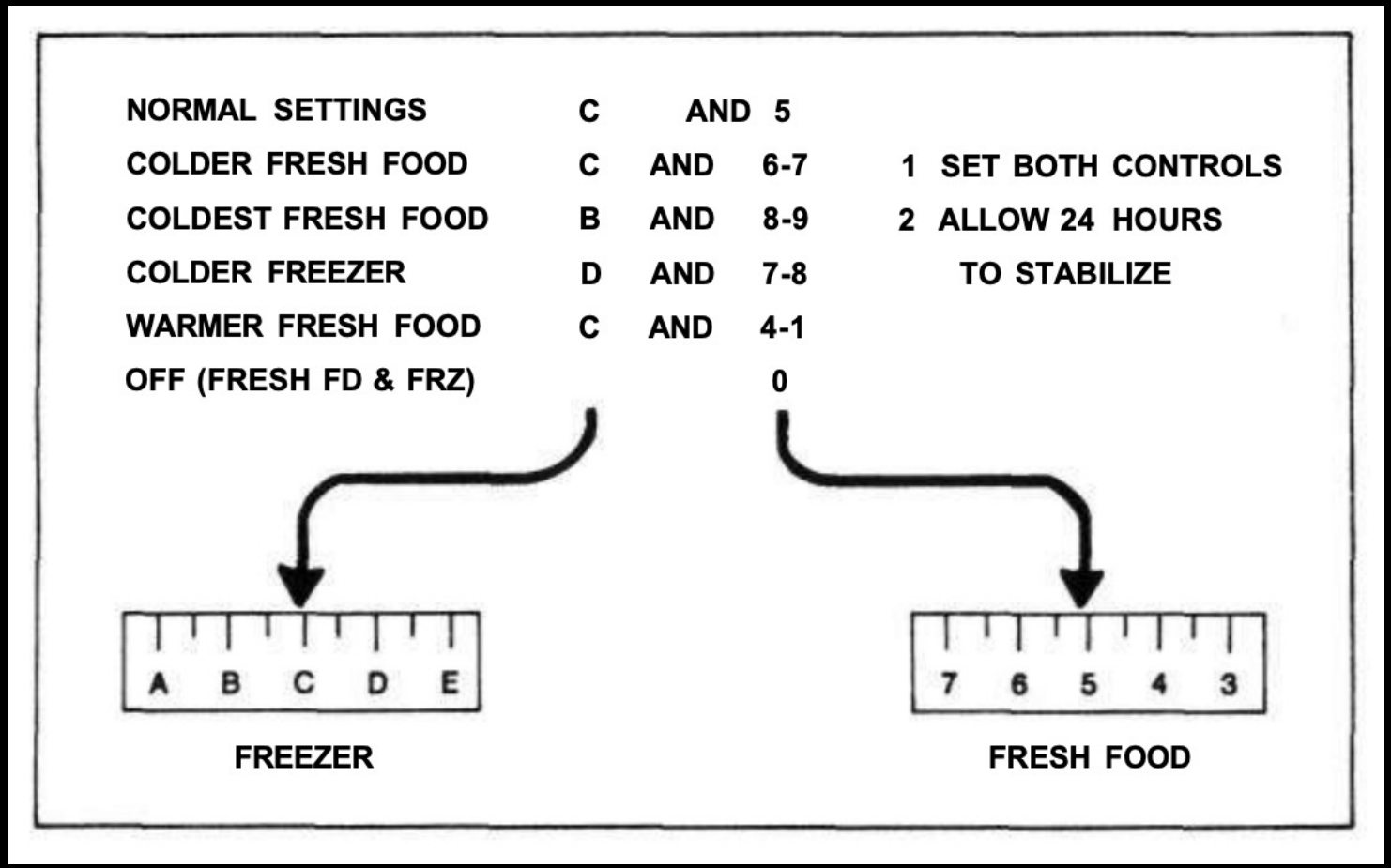
- Update mental model in response to breakdowns
- Matching the implementation model is not necessary

Mental Models

- Problem: freezer too cold, fresh food just right

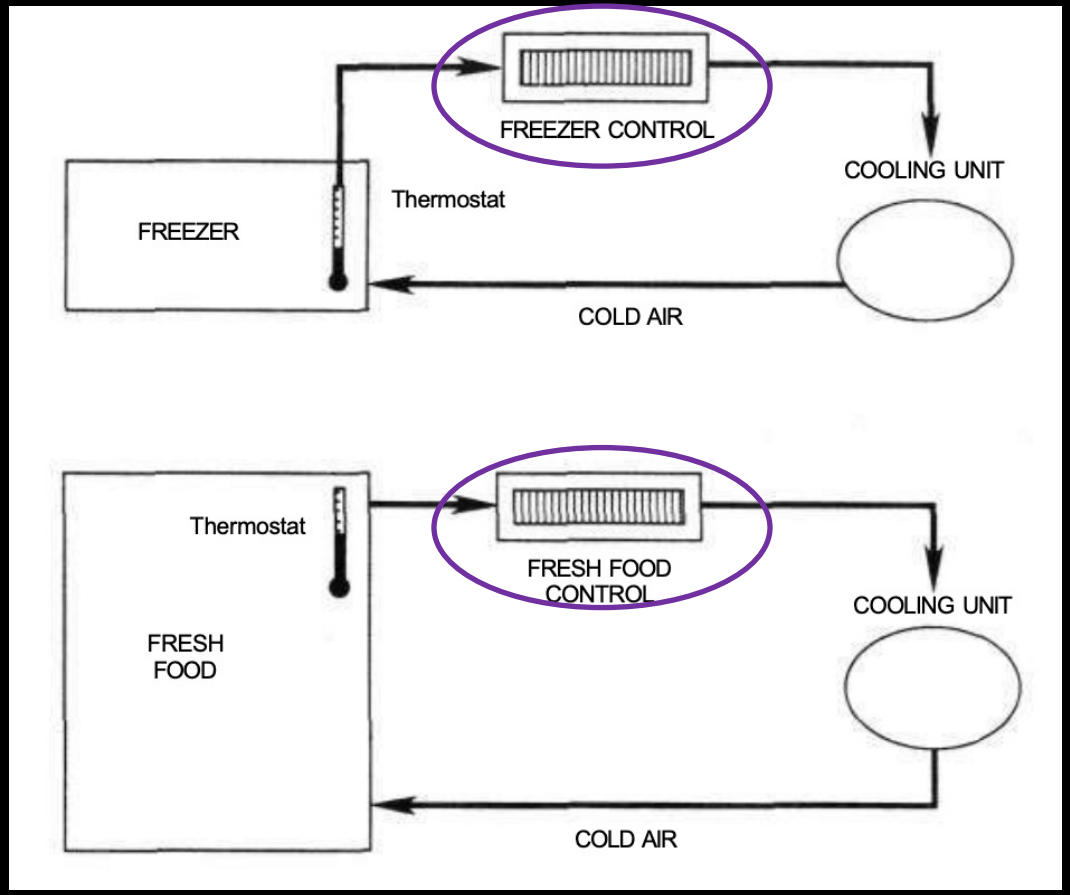


Manifest Model



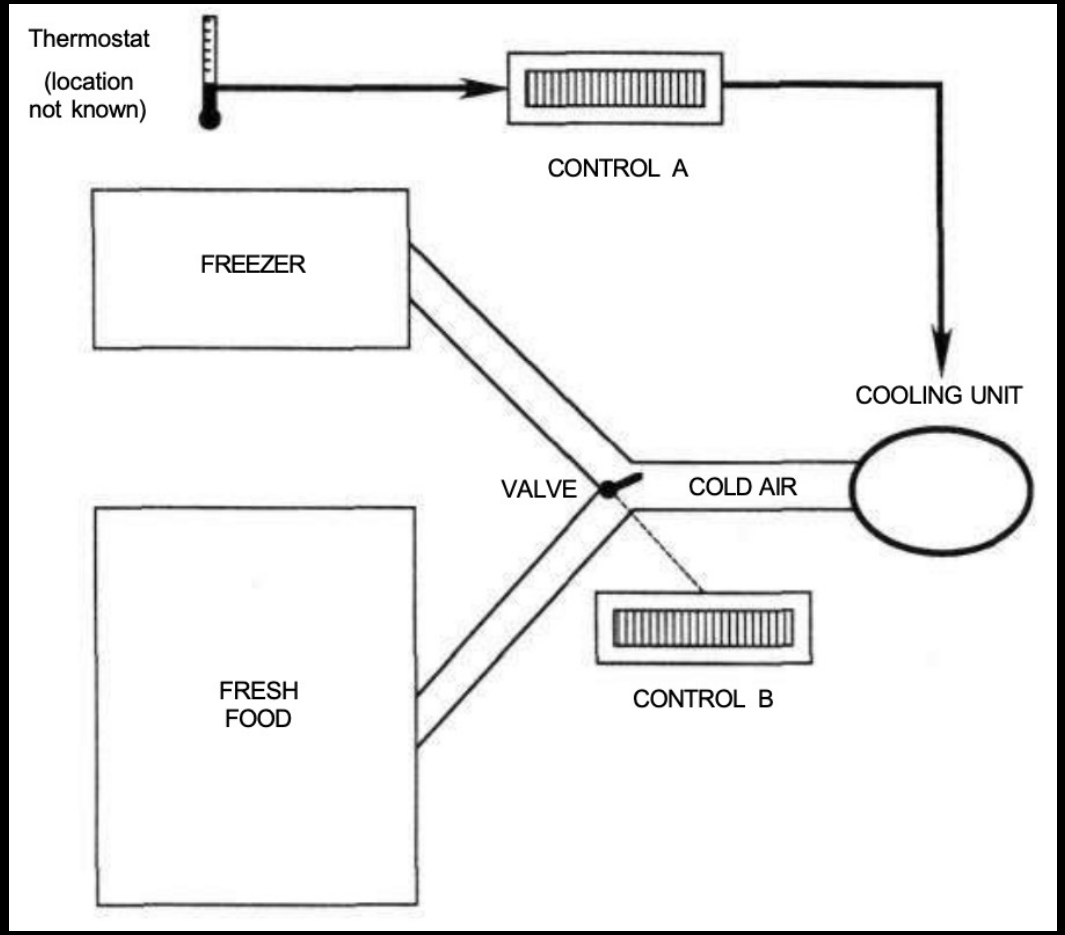
What if I want to make just the freezer warmer?

A Sensible Mental Model

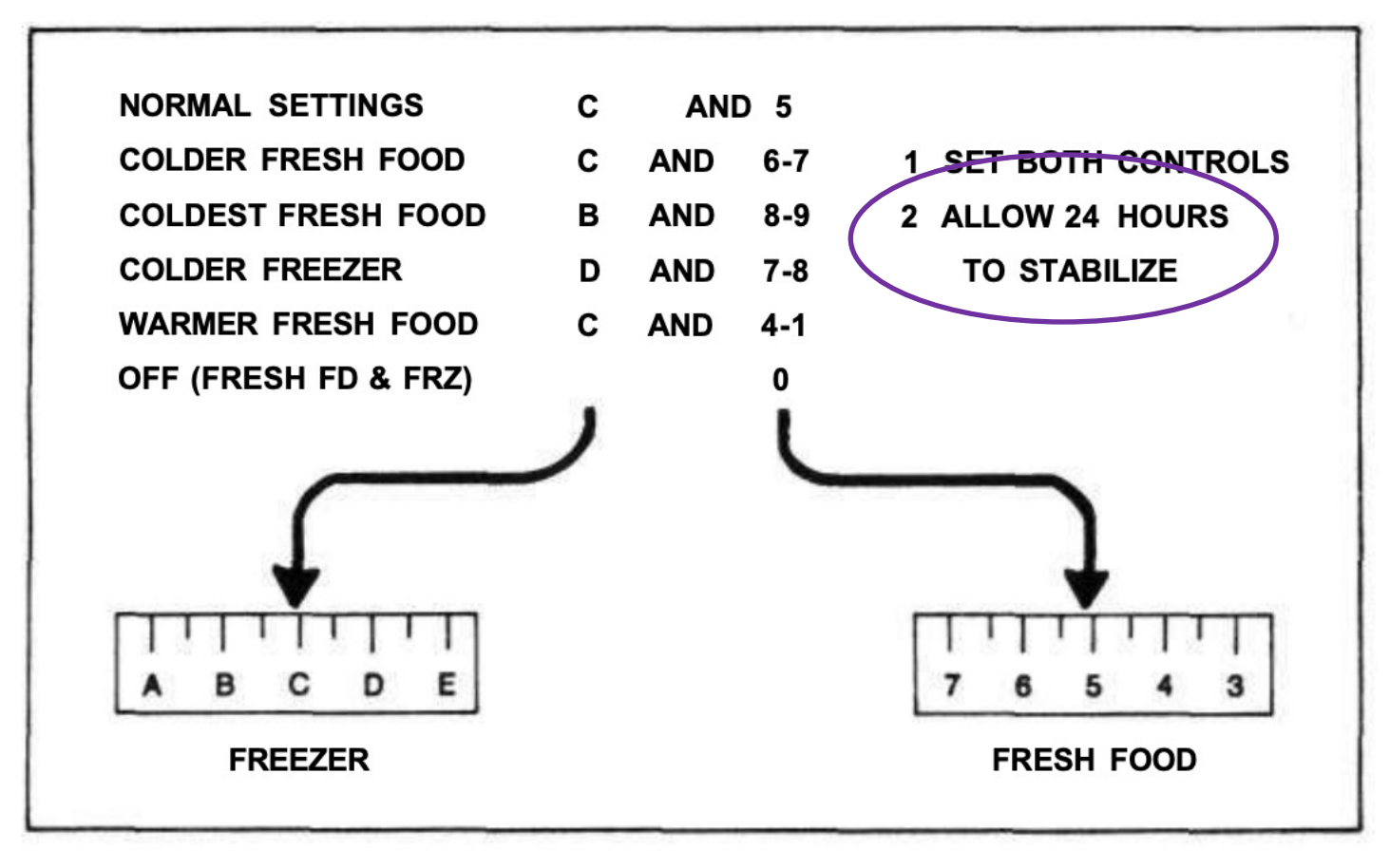


"The Freezer Control controls the freezer temperature and the Fresh Food Control controls the fresh food temperature"

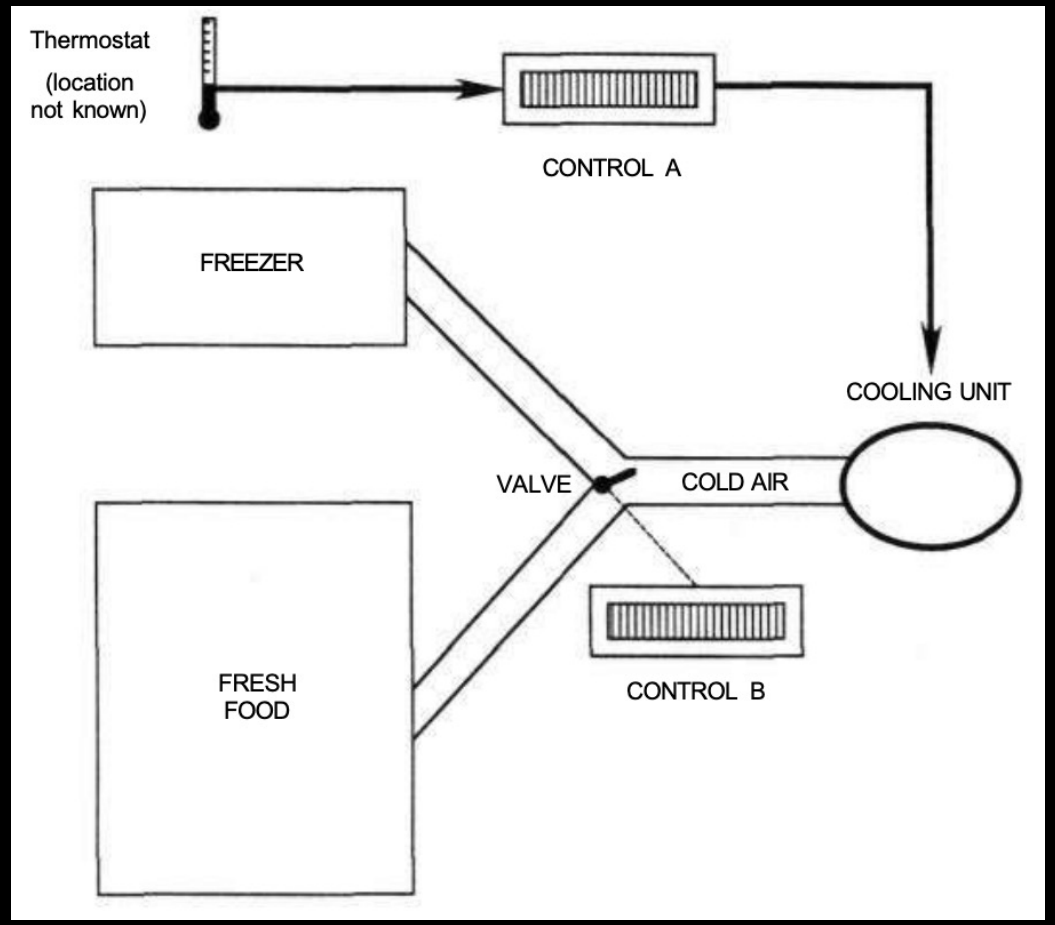
The Implementation Model



A Problem with Feedback



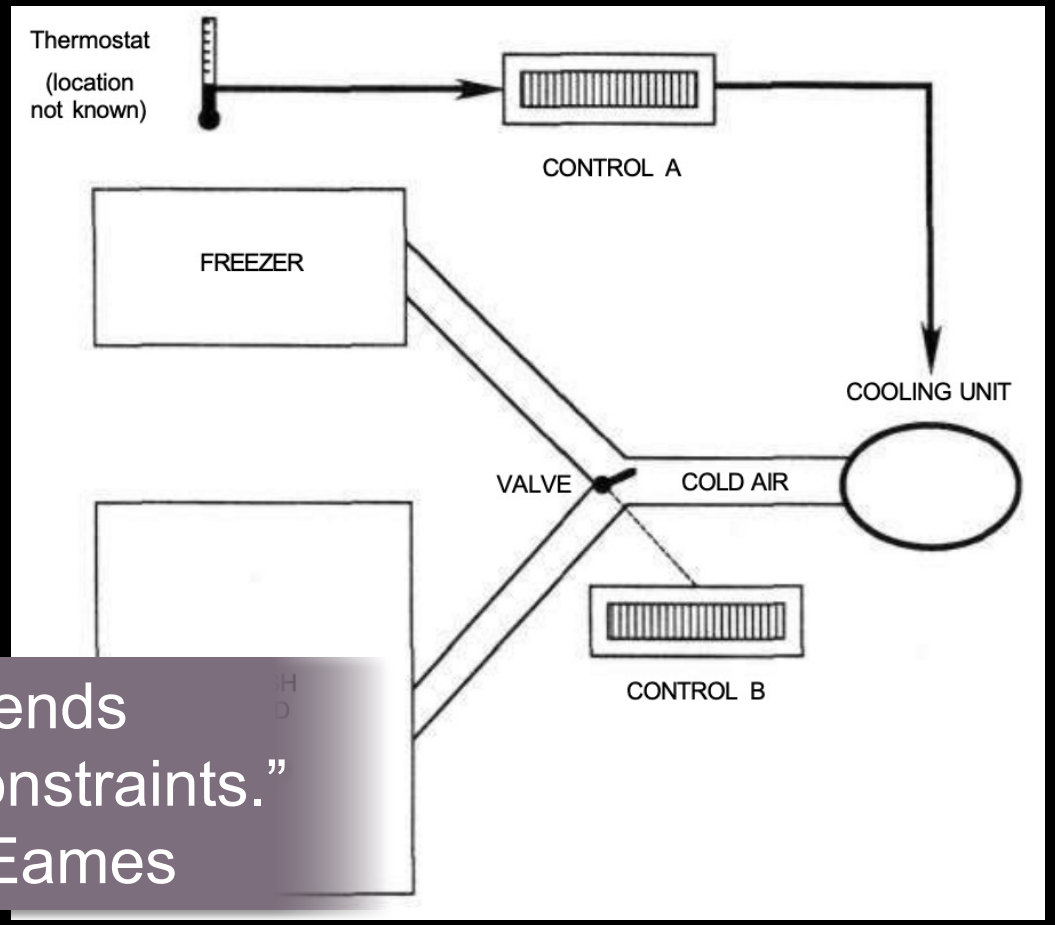
The Implementation Model



Why is the system designed like this?

Can you fix the problem?

The Implementation Model



"Design depends largely on constraints."
Charles Eames

Why is the system designed like this?

- Cost constraints, probably

Can you fix the problem?

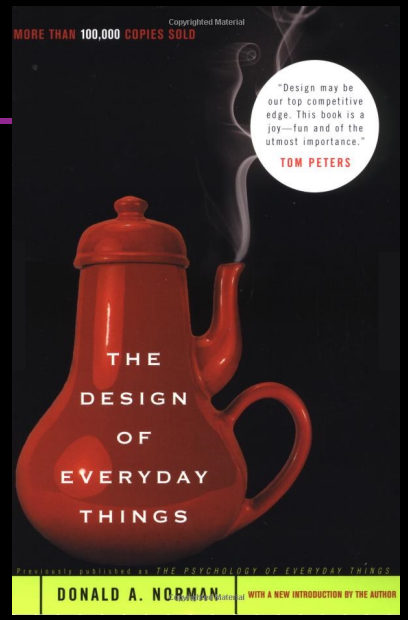
- Make controls correspond to a person's mental model

OR

- Make controls correspond to the implementation model

Building the Right Model

Having **the right model** helps people bridge the Gulf of Execution and the Gulf of Evaluation

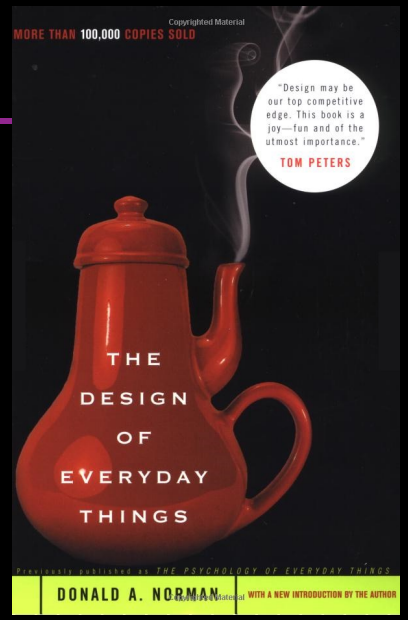


How can we help people build the right models:

- Affordances
- Visibility
- Constraints
- Consistency
- Metaphors
- Knowledge in the World
- Mapping
- Modes

Building the Right Model

Having **the right model** helps people bridge the Gulf of Execution and the Gulf of Evaluation



How can we help people build the right models:

Today

- Affordances
- Visibility
- Constraints
- Consistency
- Metaphors
- Knowledge in the World
- Mapping
- Modes

Coming soon…!

Affordances

Visual clue to interaction

- knobs afford turning
- levers afford moving
- buttons afford pushing

Affordances

"The affordances of the environment are what it offers animals, what it provides or furnishes, for good or ill."

Gibson, ecological approach to psychology

"The term 'affordance' refers to the perceived and actual properties of the thing, primarily those fundamental properties that determine just how the thing could possibly be used."

Norman

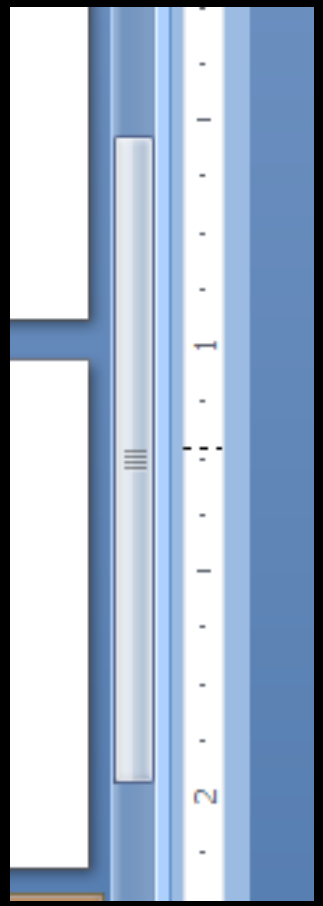
What's the Affordance?

Affordances

Affordances

Digital affordances are often
based in affordances from the physical world

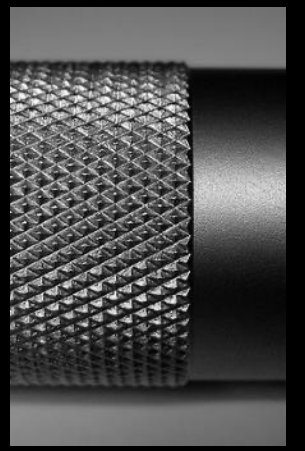
Affordances



What is the affordance?

Where does it come from?

Knurling



In Other Words

An affordance is what a thing communicates about how it can be used, often by its appearance

"In general, when the apparent affordances of an artifact matches its intended use, the artifact is easy to operate. When apparent affordances suggest different actions than those for which the object is designed, errors are common."

Gaver

Challenges arise if there is a mismatch between implied use versus intended use

False Affordances

- When there is perceptual information suggesting an implied use that does not exist

(Just an image of a button, not one that responds)

False Affordances

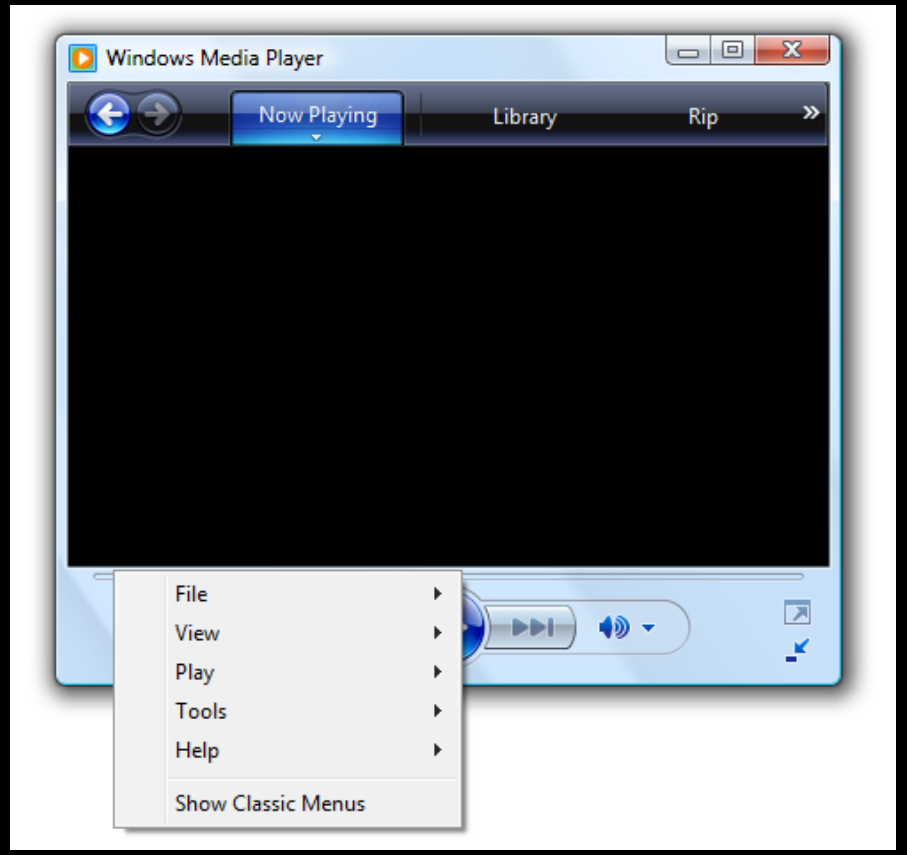
False Affordances

False Affordances

False Affordances

Hidden Affordances

When there is no perceptual information suggesting an actual intended use



Intro to Inclusive Design

(And how people fail at it)

BEWARE: The [Disability] Dongle

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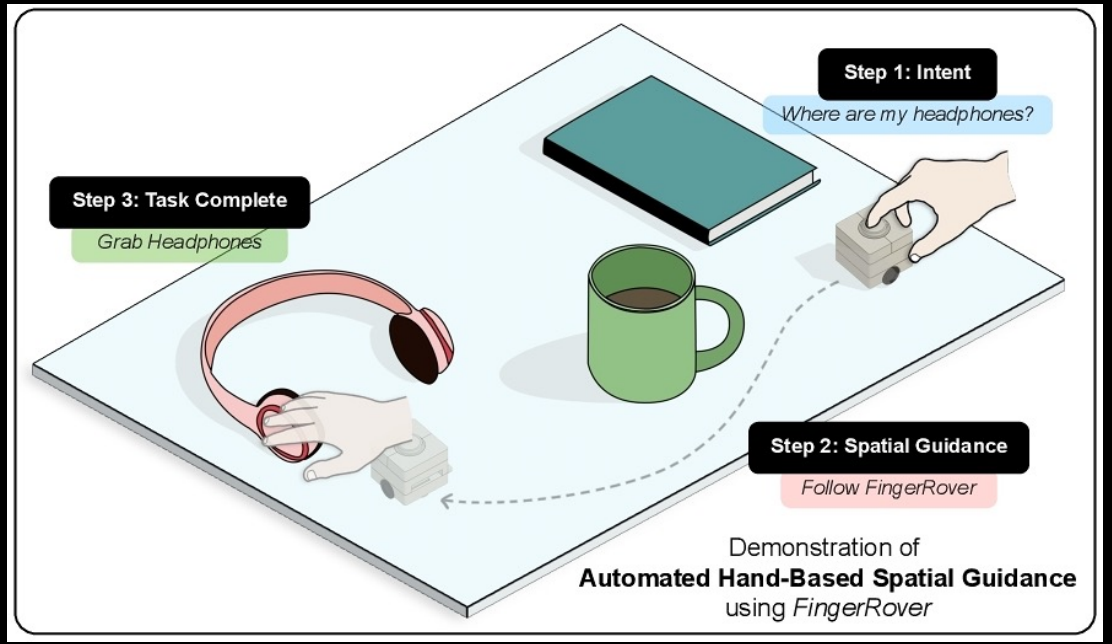
Good (-ish) Intentions + Lack of Understanding =

BEWARE: The [Disability] Dongle

Good (-ish) Intentions + Lack of Understanding =



Rahman et al., *Take My Hand: Automated Hand-Based Spatial Guidance for the Visually Impaired.* CHI '23

BEWARE: The [Disability] Dongle

Good (-ish) Intentions + Lack of Understanding =

BEWARE: “Be Normal” Designs

If the challenge is that certain audiences navigate the world differently…

…the answer is almost never to try to *“make the audience behave “normally””*

BEWARE: “Be Normal” Designs

If the challenge is that certain audiences navigate the world differently…

…the answer is almost never to try to *“make the audience behave “normally””*

<u>Change the system, not your audience!</u>

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- Affordances

Inclusive Design (and how people fail at it)

- Design Tradeoffs & Value-Sensitive Design
- Can One Size *Really* Fit All?

Which is the Best Shopping Cart?

Design Tradeoffs

Reusable Travel Mug

Keeps Coffee Warm

Holds a lot of coffee

Reusable

Expensive

Design Tradeoffs

Reusable Travel Mug

Keeps Coffee Warm

Holds a lot of coffee

Reusable

Expensive

Disposable To-Go Cup

Keeps Coffee Warm

Only holds a little coffee

Disposable

Affordable

Design Tradeoffs

Reusable Travel Mug
Keeps Coffee Warm
Holds a lot of coffee
Reusable
Expensive

Disposable To-Go Cup
Keeps Coffee Warm
Only holds a little coffee
Disposable
Affordable

Soup Takeout Container
Keeps Coffee Warm
Holds a lot of coffee
Reusable (?)
Affordable

Design Tradeoffs

Reusable Travel Mug

Keeps Coffee Warm

Holds a lot of coffee

Reusable

Expensive

Socially acceptable

Disposable To-Go Cup

Keeps Coffee Warm

Only holds a little coffee

Disposable

Affordable

Socially acceptable

Soup Takeout Container

Keeps Coffee Warm

Holds a lot of coffee

Reusable (?)

Affordable

Socially "dubious"

Value-Sensitive Design

"Value Sensitive Design is a theoretically grounded approach to the design of technology that accounts for human values in a principled and comprehensive manner throughout the design process."

Friedman, Kahn & Borning, 2013

Value-Sensitive Design

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EX: Privacy by Design

TASK: Design a privacy-sensitive crosswalk pedestrian sensor

Typical Design

- Send raw footage from traffic cameras to server
- Perform analysis to produce “signal”
- Return signal to traffic lights

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TASK: Design a privacy-sensitive crosswalk pedestrian sensor

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- Send raw footage from traffic cameras to server
- Censor video before analysis
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Typical Design

- Send raw footage from traffic cameras to server
- Censor video before analysis
- Perform analysis to produce “signal”
- Return signal to traffic lights

PbD Design

- Design new sensor using IR sensing (privacy protective)
- Process on-device
- NO data retention

Whose Values?

Often, it's just the designer's values

(…and their biases)

Good designers know to account for their own biases!

(This is why learning design is important!)

Design Research is a possible remedy

More on this soon!

Value Mismatches

When a design's values don't align with the user's values:

- Hostile/Exclusionary Systems
- Disability Dongles
- Abandoned Designs

Important:
People know what they value!

Trying to change a user's values isn't a solution here

Taking a step back: *Your Project Ideas*

Every system has SOME values it considers

- Whose values?
- Is there space for incorporating *new* values?

What values do people bring with them?

- What tradeoffs are we forced to make?
- "People who care about [value]" *is* a valid audience for you to design for!

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