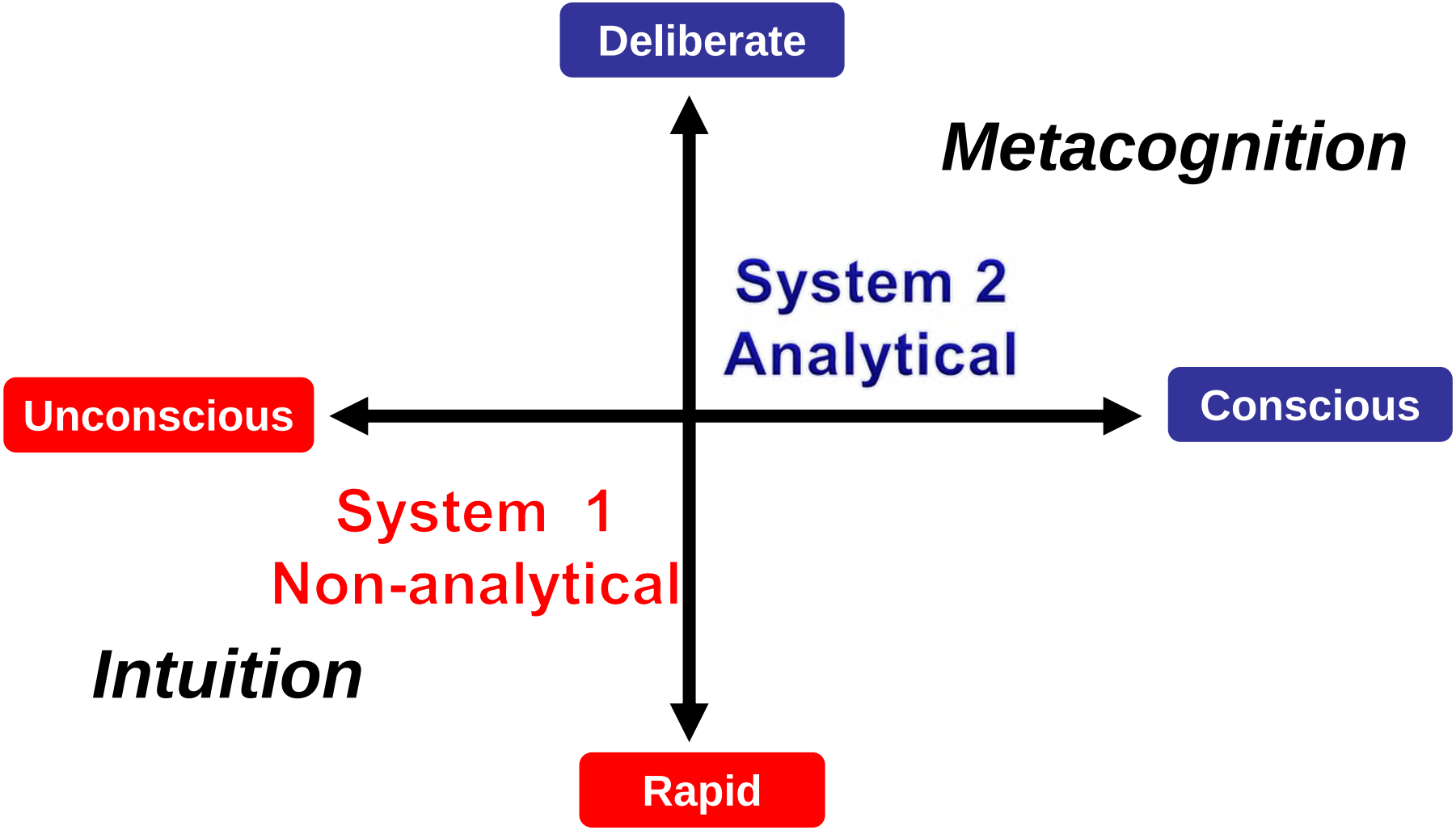
# THE ART & SCIENCE OF EXPERT THINKING

**A key to superior clinical reasoning and medical decision-making**

# Objectives

- Describe cognitive processes of expert thinking in clinical reasoning and decision-making
- Apply teaching methods that will assist learners in utilizing expert thinking in clinical settings
- Develop individual approaches to incorporate the concept of expert thinking into various settings

# Dual-Process Model of Reasoning




*Quirk, M 2006*
*Croskerry 2003*

# Cognitive Exercise:

## An 18-month old with fever and swollen eyes

# What is the Diagnosis?

**6 month old with seizures**

# System 1


*"Trust sense of familiarity"*

# System 1: Intuition

- Experience is translated into action without intervention of any reasoning process.
- Experts address, integrate and make sense of multiple complex pieces of data subconsciously.
- “Pattern recognition” & “Illness script”

**“Thinking without thinking”**

# Early initial hypothesis

- Correct Dx hypothesis considered once during the encounter predicts Dx accuracy, *OR 15, 95% CI (1, 219)*
- Correct Dx hypothesis within the first 10 questions predicts Dx accuracy, *OR 24, 95%CI (2.6, 222)*
- Correct Dx considered within 5 min, 95% chance of reaching a correct Dx

Neufeld 2004
Nendaz 2006

# Can you memorize this?

**DRAHSISNRETTAPGNIYFITNEDI**

**IDENTIFYING PATTERNS IS HARD**

**Learning in ‘chunks’ help organize the knowledge**

# What Makes The Expert?

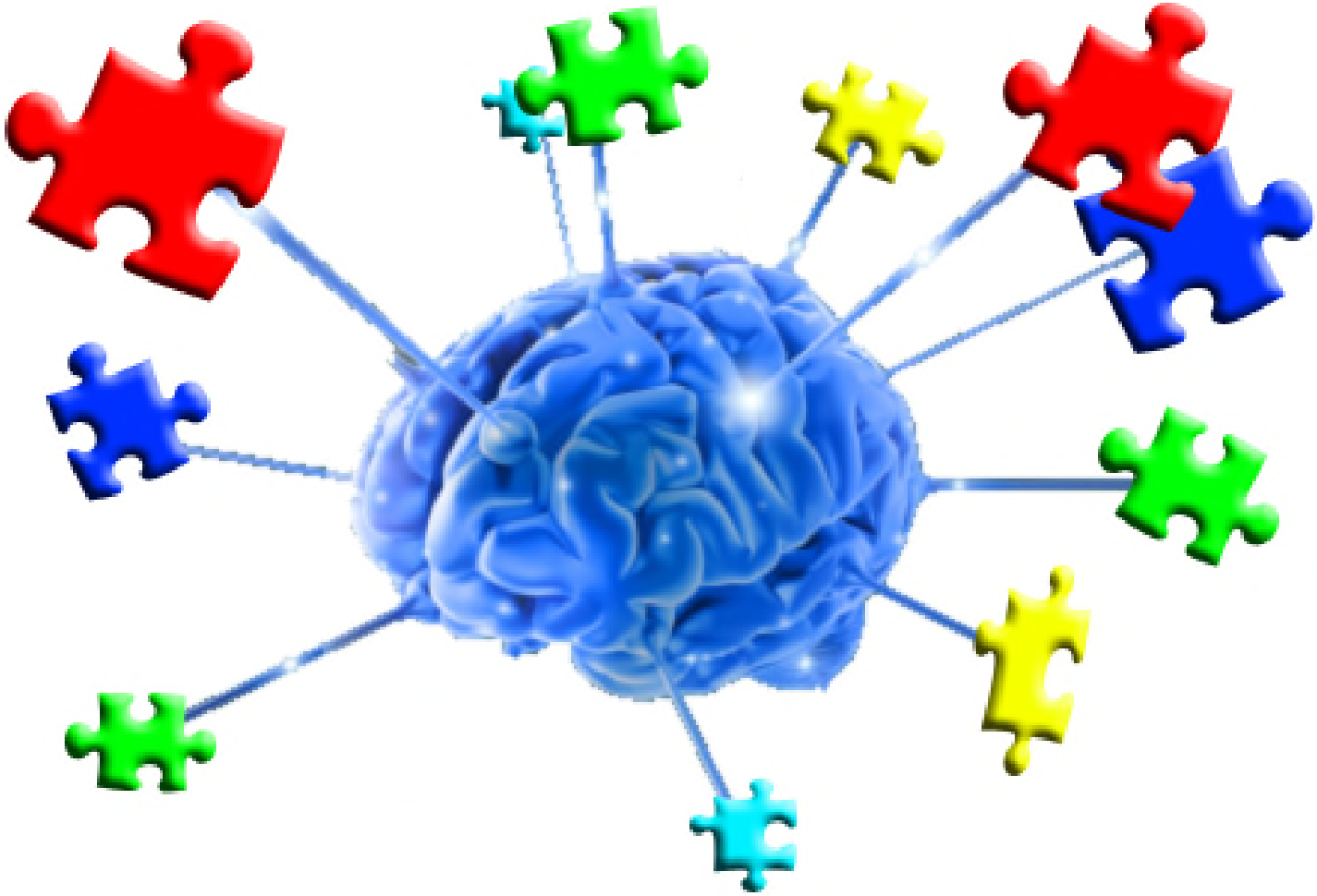
"…no amount of rules or facts can capture the knowledge an expert has when he has stored his *experience* of the actual outcomes of tens of thousands of cases."

**Experiential Leaning**

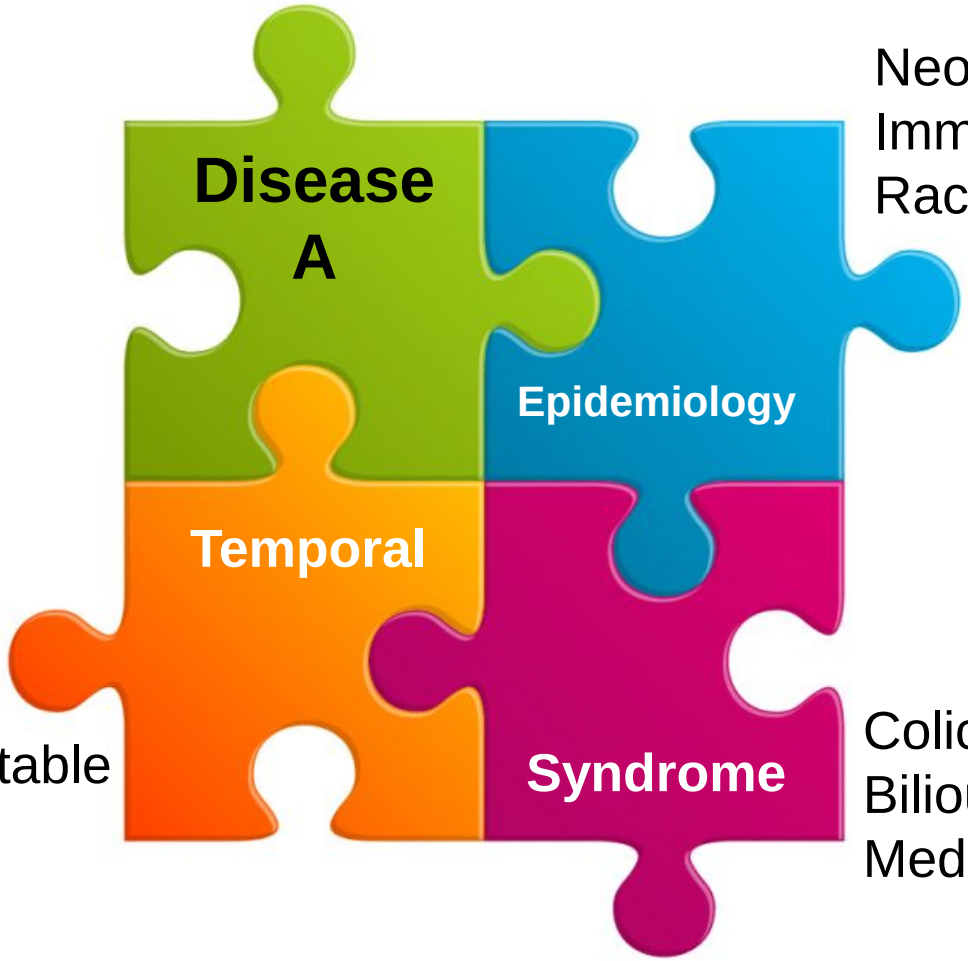
Dreyfus & Dreyfus, 1986

Mylopoulos et al. Academic Medicine 2012

# Organized Knowledge = Expertise



# Illness script: semantic qualifiers




Neonate vs. Older
Immunocompromised
Race

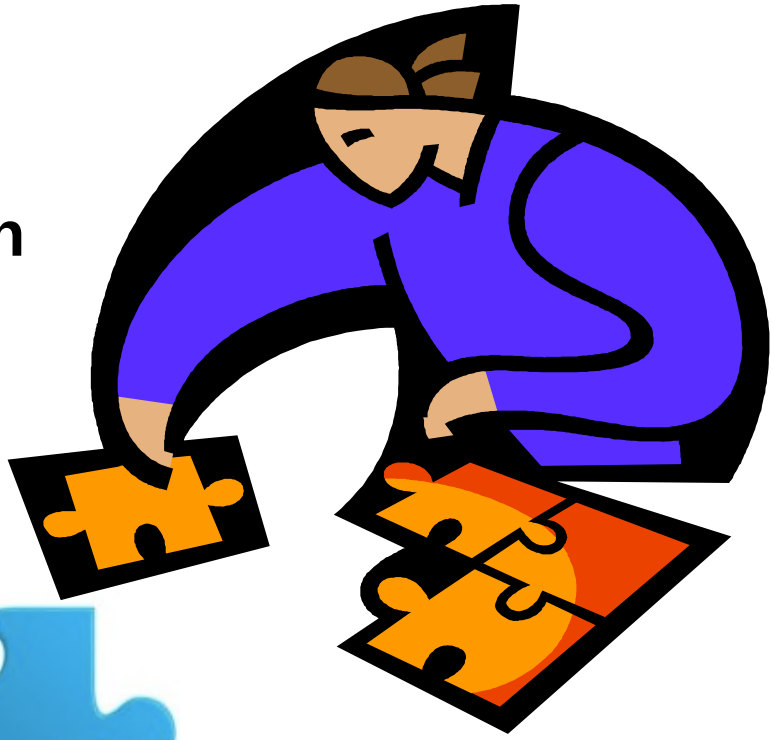
Acute vs. Chronic
Progressive vs. Stable

Colicky vs. Visceral pain
Bilious vs. Non-bilious
Medical vs. Surgical

**“The Key to Expert Pattern Recognition”**

# Sort Out Illness Scripts


**A man with knee pain**




# Create & Compile  Illness Scripts = Organize knowledge


# Patient Story

- A 72-year old white man presents with knee pain that  woke him up from sleep; “the worst pain I’ve ever had.”  The knee was normal before he went to bed; now it’s also swollen.  He had similar problems 9 months and 2 years ago.

# Problem representation

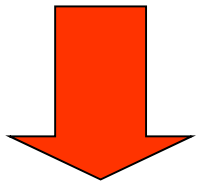
"Here's an **older** man with an **acute**, **recurrent** attack of **severe** pain in a **single**, **large** joint, a **mono-**arthritis. This could be gout or septic arthritis."

# Semantic qualifiers

| | | |
|---|---|---|
| 1- Pt char. | *Mr. S., 72* | **Older man** |
| 2- Site | *R. knee* | **Mono, Large** |
| 3- Course | *Last year* | **Episodic** |
| 4- Severity | *Blankets* | **Severe** |
| 5- Context | *Night* | **At rest** |
| 6- Onset | *Last night* | **Acute** |

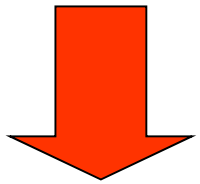
# Access to ‘illness script’

Older man
Acute onset
Recurrent
Mono, large joint



Gout,Septic arthritis

Woman
Gradual onset
Chronic
Poly, small joint



Rheumatoid arthritis

# PAIRED EXERCISE

**1. Problem representation:**

**Synthesize, Use Semantic qualifiers, Capture 3 components**


**2. Generate three DDx based on your problem representation**

**DDx:**

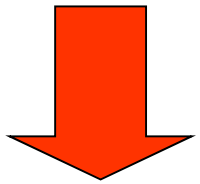
**1.**

**2.**

**3.**

# EXAMPLE-‘illness script’

Older man
Acute onset
Recurrent
Mono, large joint



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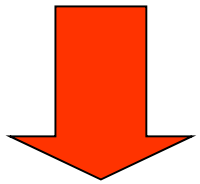
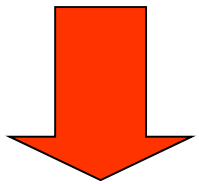


Rheumatoid arthritis

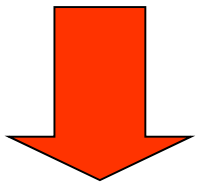
# Compare & Contrast Scripts

Acute onset
Fever, Leukocytosis
Marked tenderness
Rapid progression
Toxic appearing
Unilateral > bilateral
Smooth, indistinct border
Risks for infection



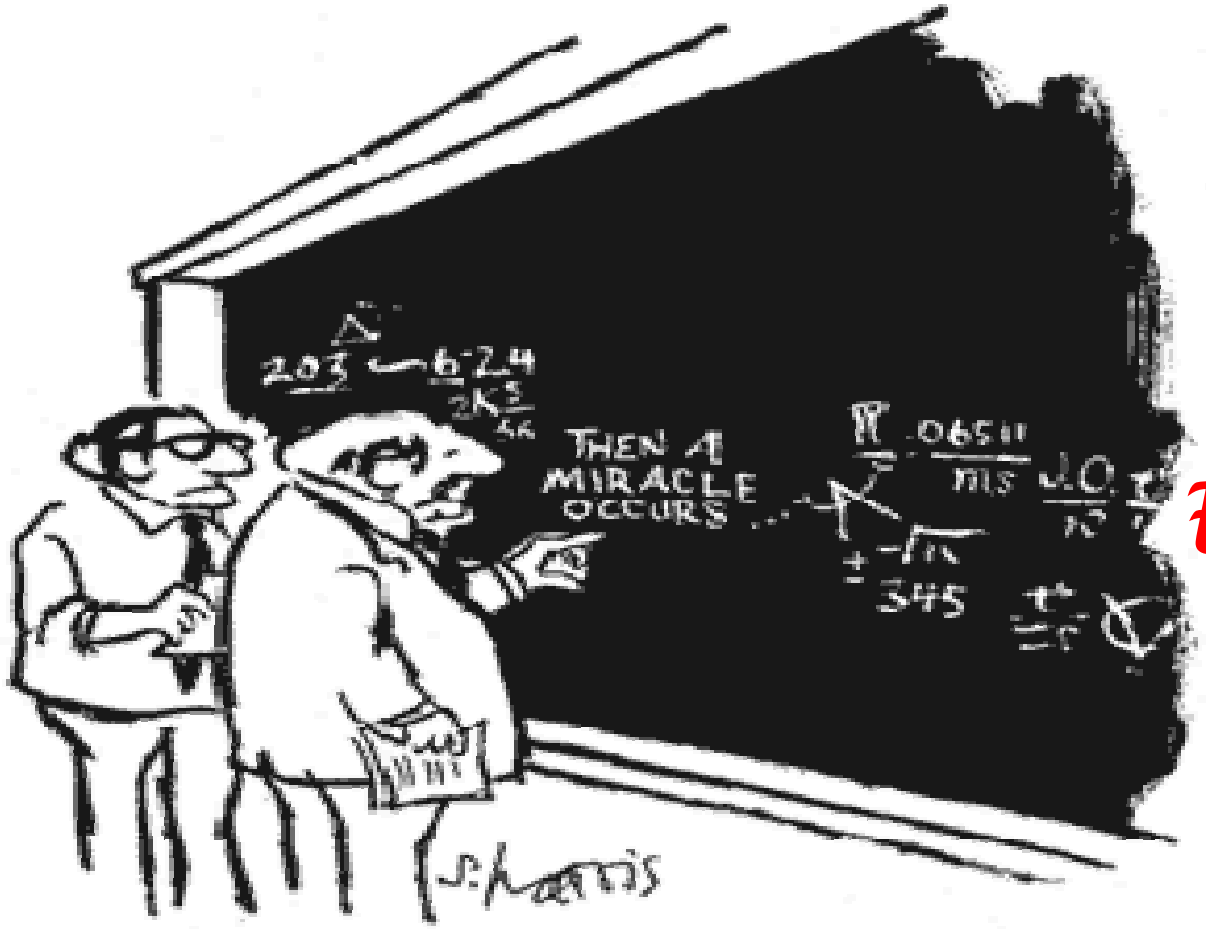
**Cellulitis**

Subacute or Chronic
Afebrile
Dull tenderness
Gradual progression
Non-toxic
Symmetric, diffusely scattered pattern
Cutaneous changes
Risks for venous stasis



**Venous stasis**

# System 1: Irrational & Unexplainable




"I THINK YOU SHOULD BE MORE EXPLICIT HERE IN STEP TWO."

Sydney Harris

*Efficient*

**but**

*Error-prone*

# Novice & Pattern Recognition

Mental availability

Actual probability

Abscess

Kawasaki's

Mononucleosis

- Illness scripts
- Mental state
- Cognitive Biases

Pharyngitis

Wrong diagnosis

# System 2



*"Think it through, then decide"*

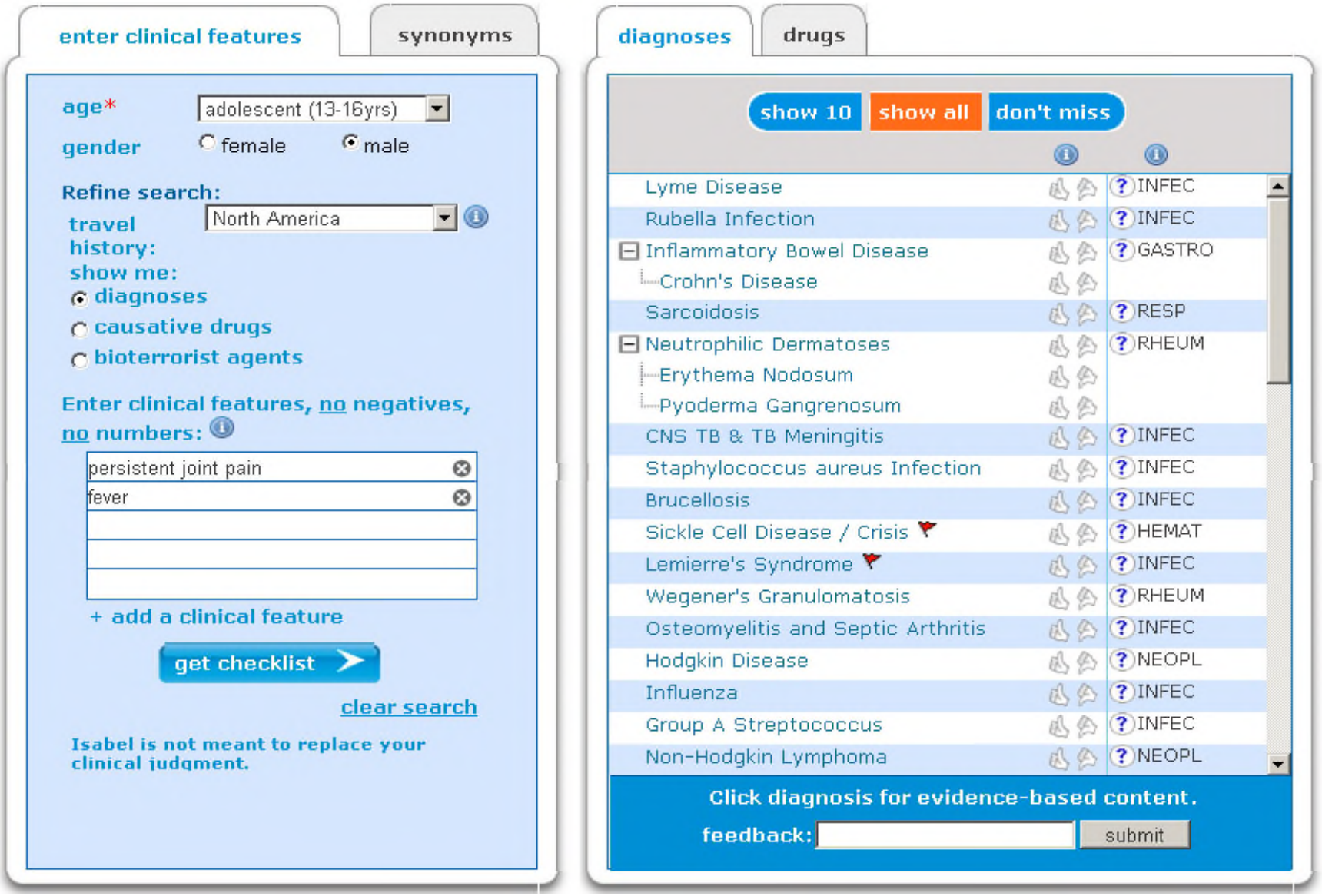
# Systematic Analysis

- Organized and Logical
  - Start with
    - Acute vs. Chronic
    - Anatomy or Structure
    - Pathophysiology or Mechanism of Illness
    - Organ System
  - Then
    - Etiology

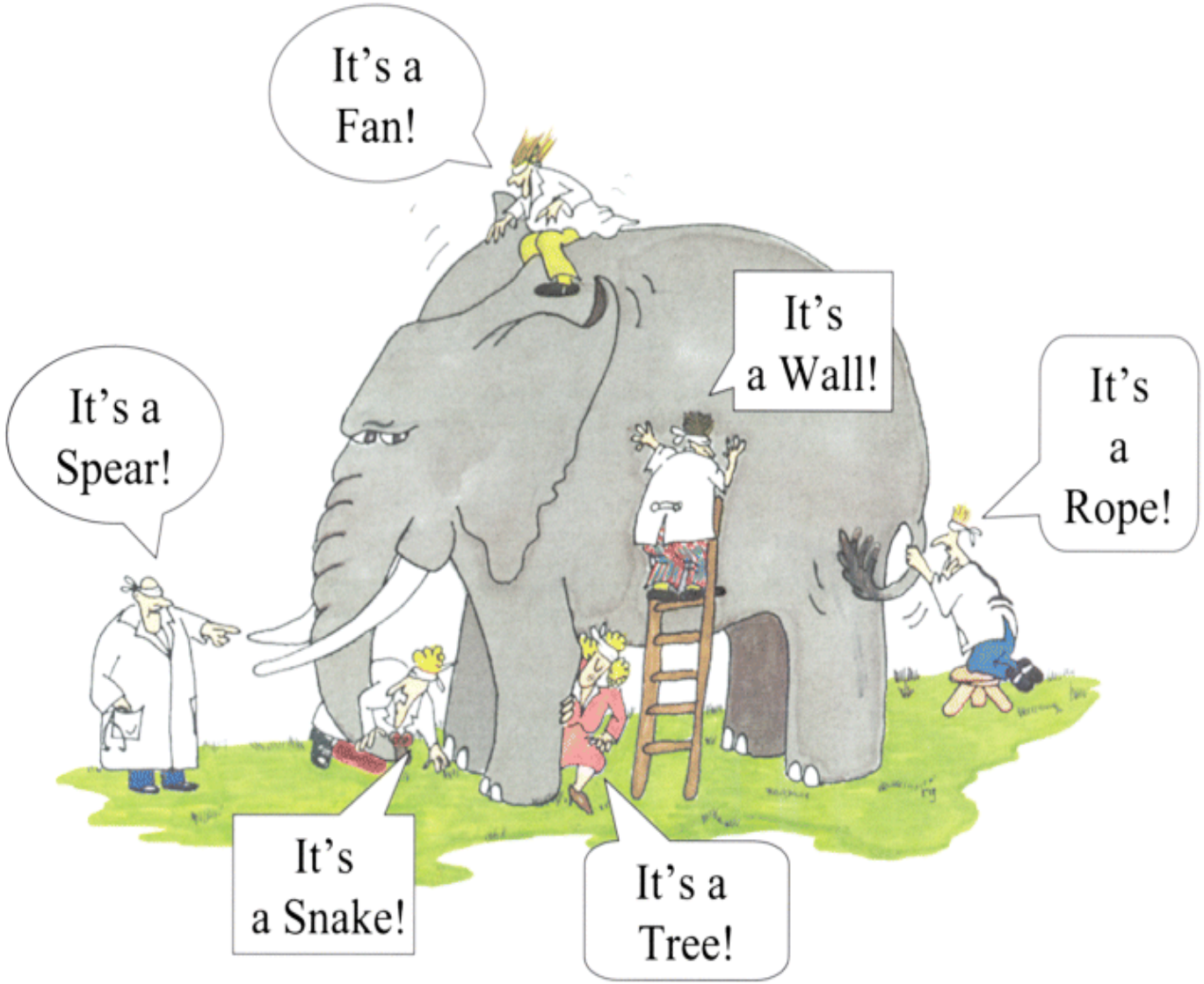
# DDx via Etiology

| | |
|---|---|
| V | Vascular |
| I | Infection and inflammatory (autoimmune) |
| N | Neoplastic (paraneoplastic) |
| D | Drugs |
| I | Iatrogenic and idiopathic |
| C | Congenital (developmental, genetic) |
| A | Anatomic |
| T | Trauma |
| E | Environmental and endocrine (metabolic) |

# Diagnostic Checklist



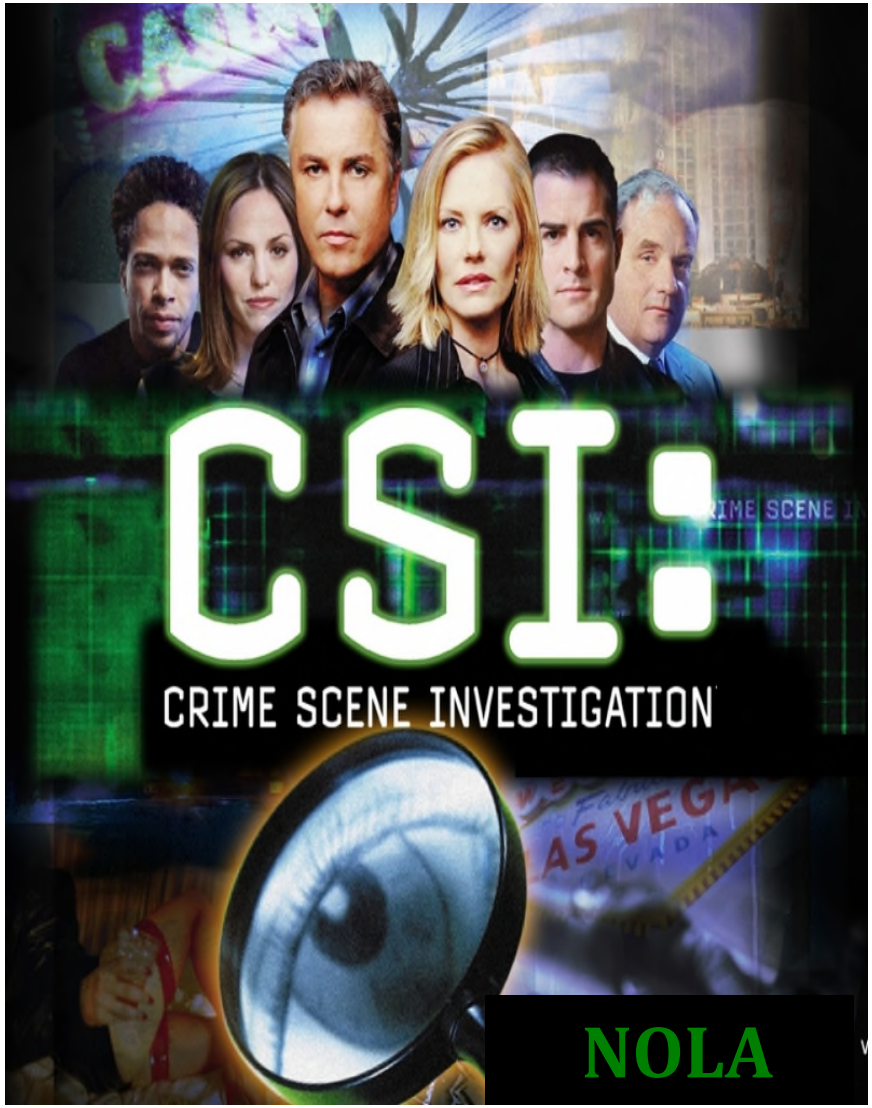
# The extent of diagnostic thinking is as good as you frame it



# A post-op teenager

- 15-yo, Hispanic male
- Admitted post op from pectus excavatum corrective surgery
- abdominal pain, fatigue

# COGNITIVE AUTOPSY




What caused the misdiagnosis?

What went wrong with the Illness script(s)?

# Cognitive Biases

- Predictable patterns of deviation in judgment that occur in particular situations and lead to cognitive errors:
  - perceptual distortion
  - illogical interpretation, or irrationality
  - inaccurate judgment
- **Universal and may be preventable using the cognitive de-biasing process**

# Common Cognitive Biases

Availability

biased by ease of recall

Framing

biased by details surrounding the clinical data

Blind Obedience

biased by authority or technology

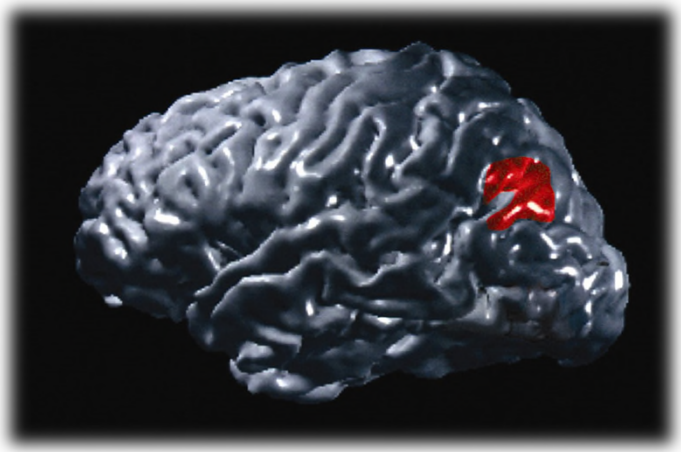
Anchoring

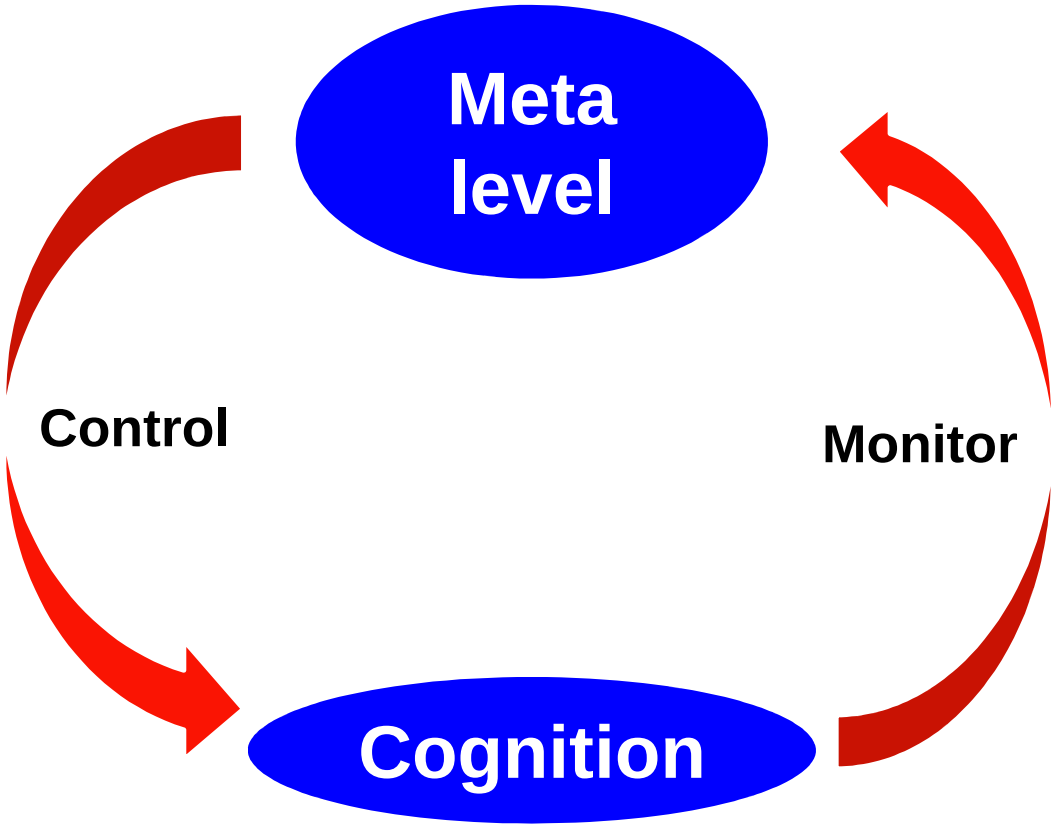
stuck on initial impression

Premature Closure

prematurely halting diagnostic workup

# Cognition vs. Metacognition

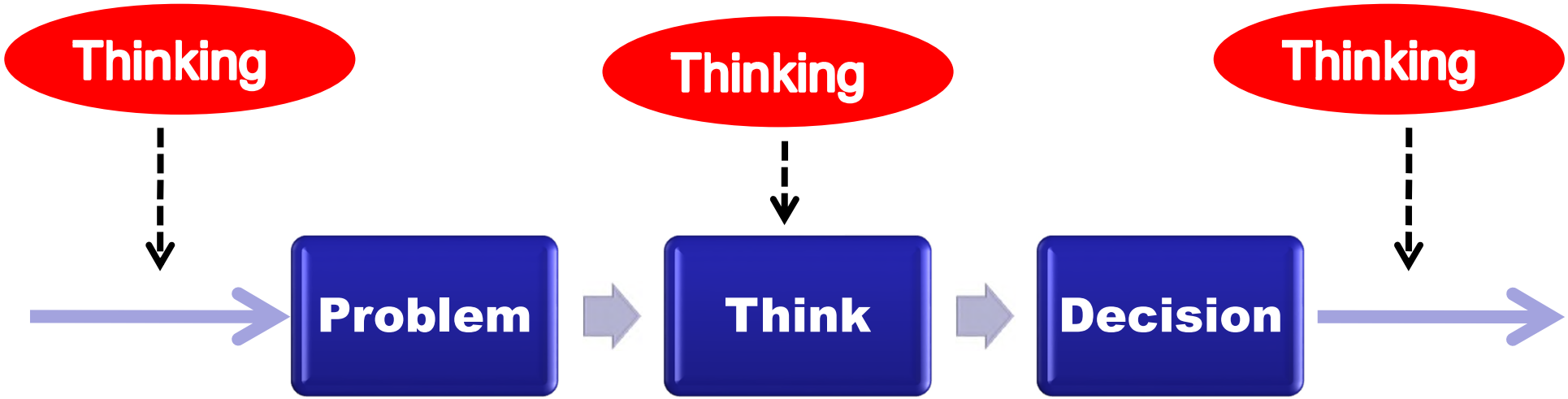





**"Thinking about one's own thinking, and others' thinking"**

*Adapted from Nelson 1990, Psych of Learning and Motivation*

# Cognitive Approach




- Making a ***plan before*** thinking episode
- ***Regulating*** thought ***during*** episode
- ***Reflecting afterwards*** to revise the decision, and plan future practices

# Cognitive Debiasing

***COGNITIVE PAUSE!***

- Did I put enough effort toward this problem?
- Did I omit anything serious/life threatening?
- Am I about to repeat my past mistakes?
- Does it make clinical/logical sense?
- Let’s think outside the box!

# Red Flag Prompt

- Objective: To determine if a “pause” and focus on isolating “red flags” strategy during diagnostic reasoning improves diagnostic performance.
- Red Flag definition:
  - a constellation of symptoms, signs, clinical data or circumstances that should lead to heightened suspicion for a serious condition and trigger additional evaluation.
- Methods:71 Pediatric resident physicians from 2 university based childrens hospitals.
  - Randomized controlled, scenario-based study which featured a 2 (Red flags: Yes/No) x 2 (Case Complexity: Complex/Simple) between-subjects measures design.
- Results/Conclusion:
  - Overall, the results show that alerting the participants to watch out for red flags significantly improves diagnostic accuracy, in general, and for complex cases in particular.

*Impact of Red Flags and Case Complexity on Diagnostic Performance among Pediatric Residents: A Randomized Controlled Vignette Study. Chartan, C[1]. Thammasitboon, S[1]. Sur, M[1]. Krishnamurthy, P[1]. Singh, H[2].*

# GROUP EXERCISE

## Slowing Down and Debiasing

**GROUP WORK**

- Discuss…
  - Identify opportunities in the case where the providers could have **slowed down** to avoid errors
  - Determine if **cognitive biases** led to the errors

# GROUP EXERCISE

## Case Reframing

**GROUP WORK**

- Consider the case from the perspective or "frame" of:
  - Resident
  - Nurse
  - Mother
- How could understanding the "frame" of each individual impact diagnostic process?
- How could this have changed their response to the situation?

# Innovations:

- Reflective Practice
- MedU
- Deliberate Practice Module

# System 1 vs. System 2

# 2-Step Expert Thinking

## The Intellectually Disciplined Process

Evaluate information matching patterns with illness scripts


Evaluate one's own thought to reduce biases

# Take Home Points

- **System 1** thinking—fast, often accurate, prone to biases
  - Problem Representation with Semantic Qualifiers AND Illness Scripts are a good way to develop **System 1** thinking
- **System 2** thinking—deliberate, often accurate, prone to framing effects
  - Cognitive debiasing and Cognitive autopsy with reframing can help improve **System 2** thinking
- It is important to know when to use **System 1** vs. **System 2**