

New Students Orientation 2012

Why We Need Theories

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These slides are available for later viewing at
http://polsci.umass.edu/profiles/peterson_mj

Why We Need Theories

I. Roots of our need for theories

II. Theories and Models

Theories

Models

How they operate together

III. Bad and Good Theories

Roots of our Need for Theories

why need

theories &
models

bad & good
theories

1. Time Crunch: mentioning every detail of what has happened takes at least as long as the events themselves

The Basic Time Crunch

development of problem

1995

start of events

9/2011

need for decision seen

information processing completed

with theories

9/2011

if have to retell and sort all details

2027

Roots of our Need for Theories

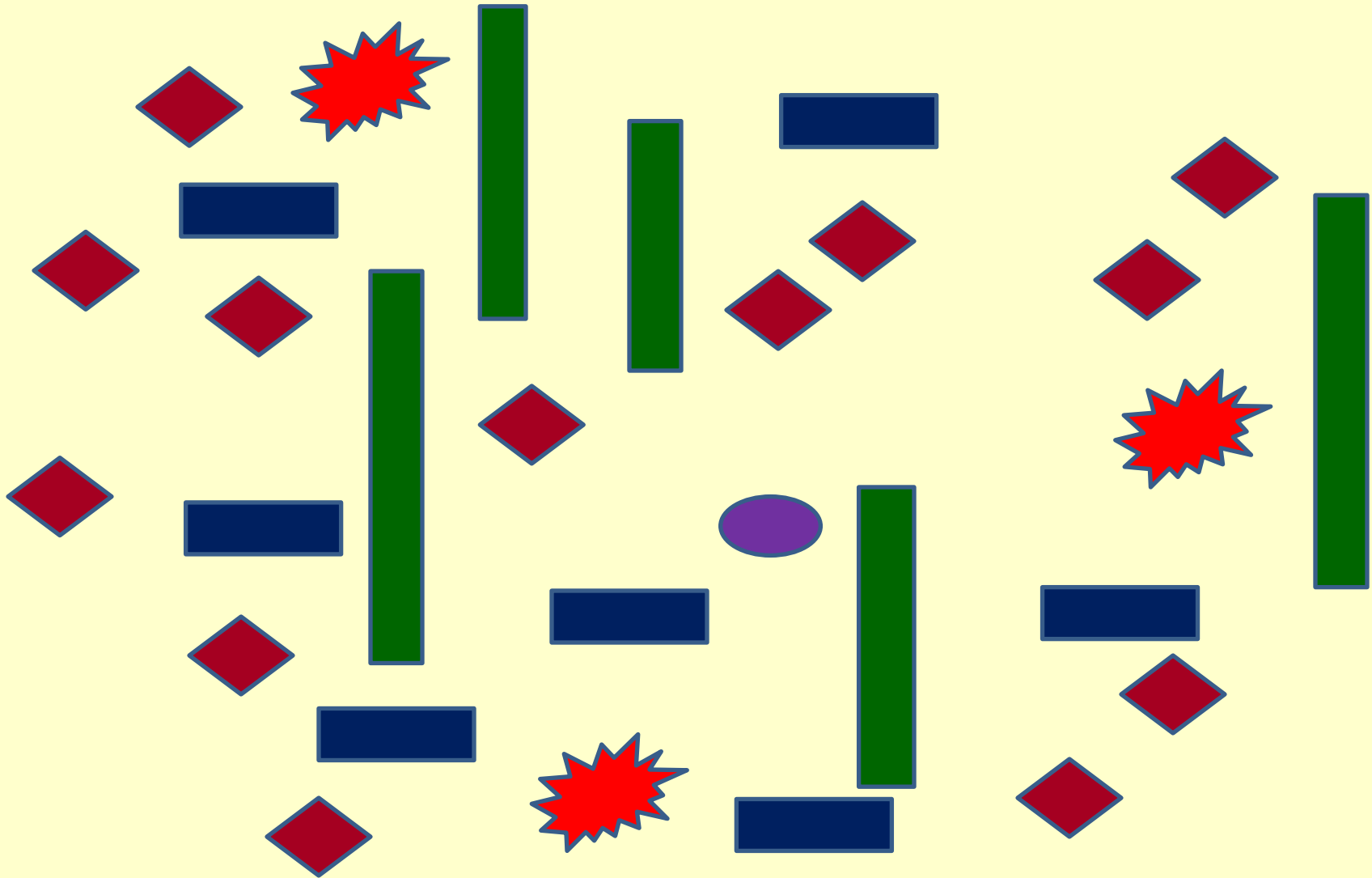
why need

theories &
models

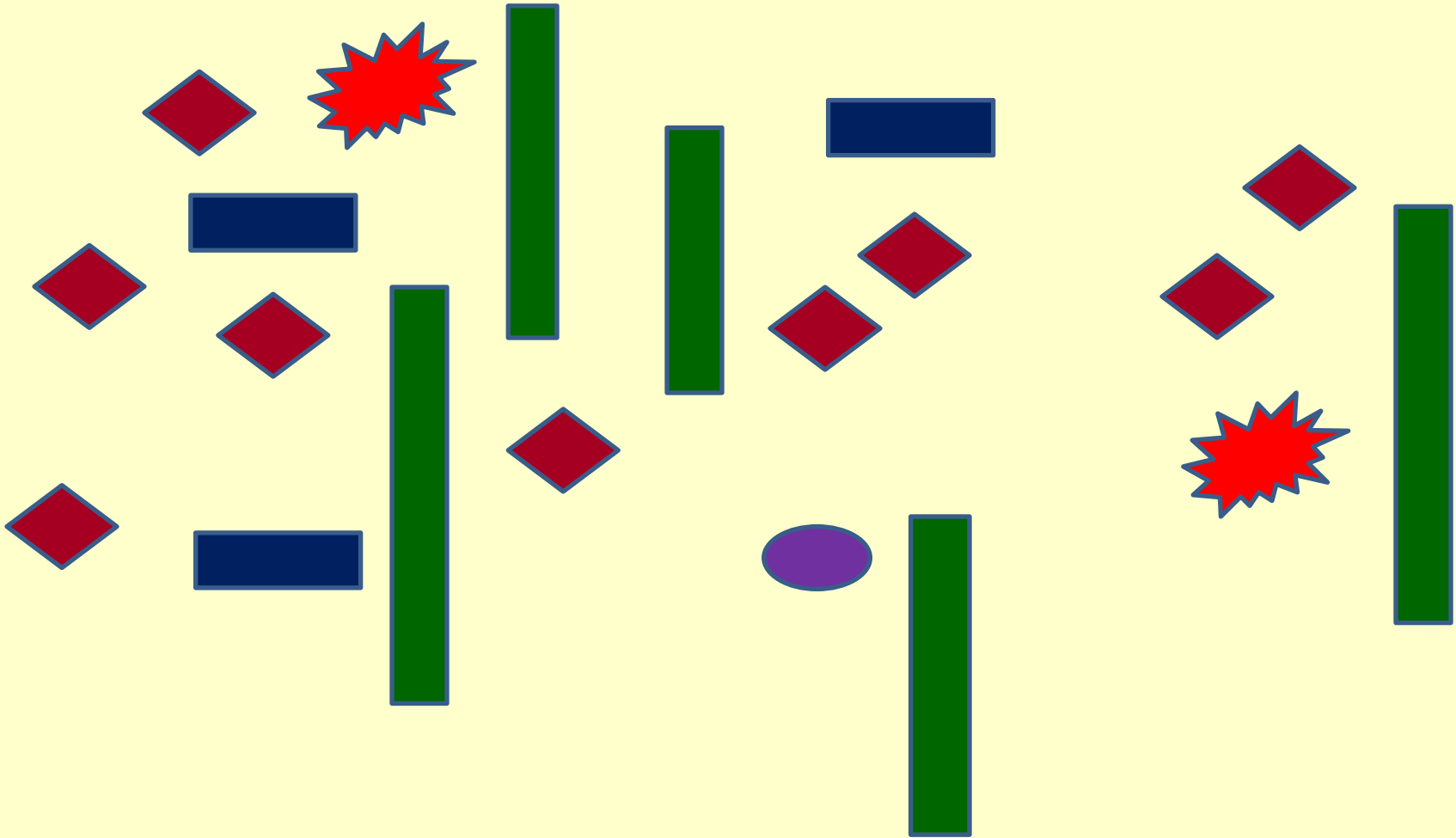
bad & good
theories

1. Time Crunch: mentioning every detail of what has happened takes at least as long as the events themselves
2. Cognitive Limitation: human ability to process incoming information is lower than flow of incoming information

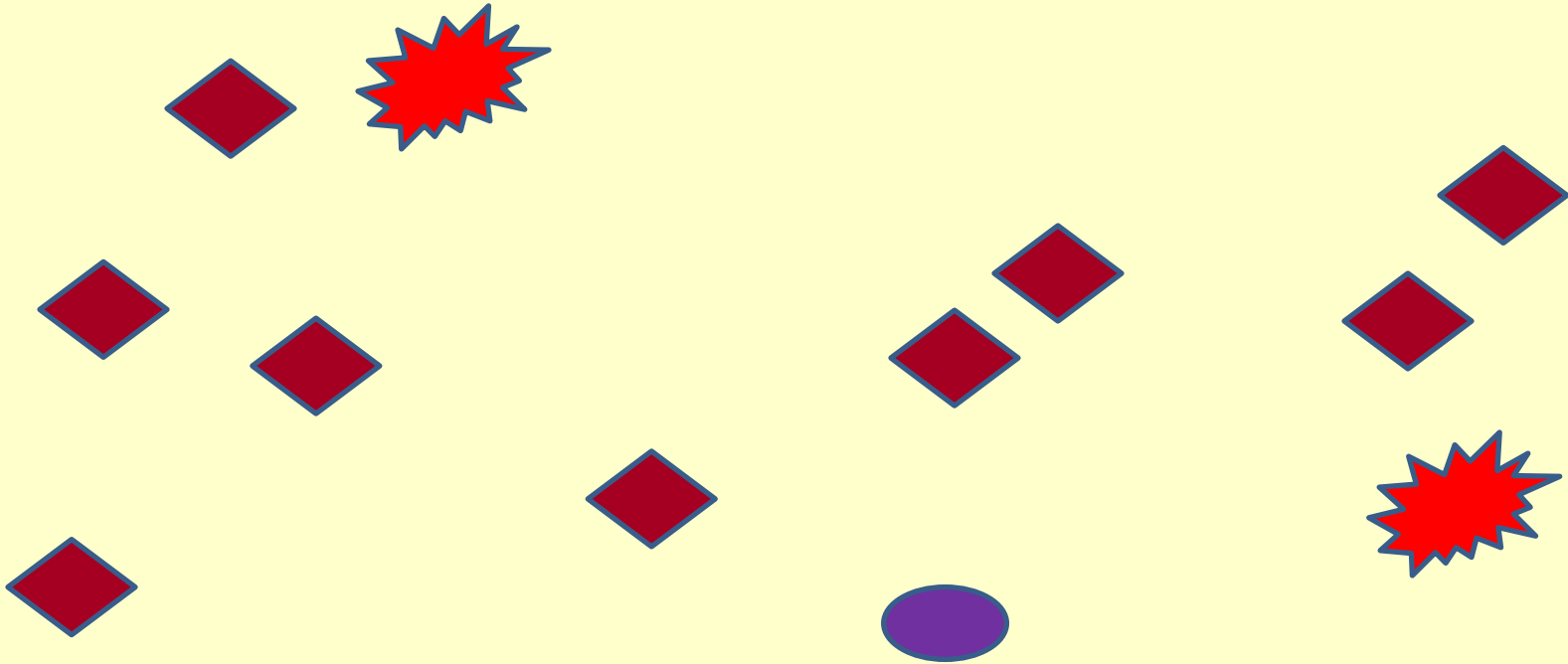
The Basic Cognitive Problem



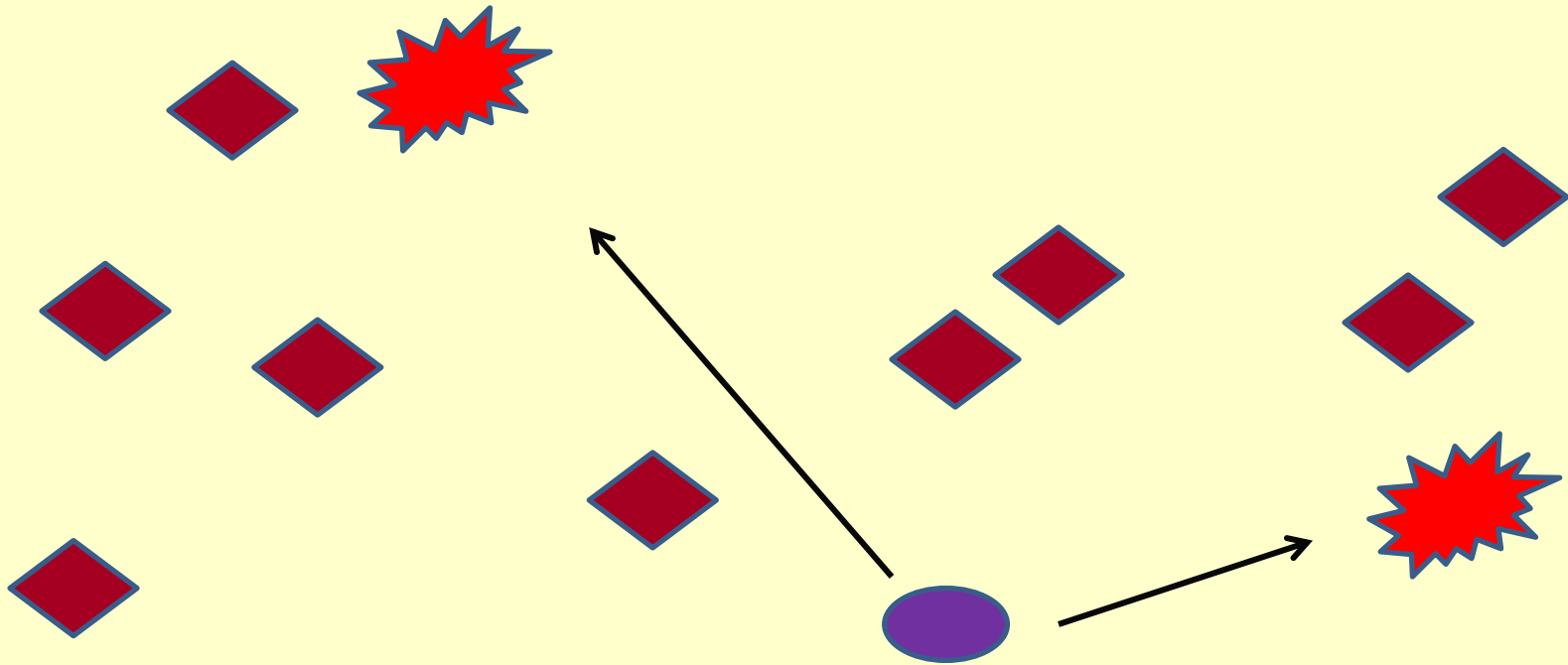
Coping by Elimination 1



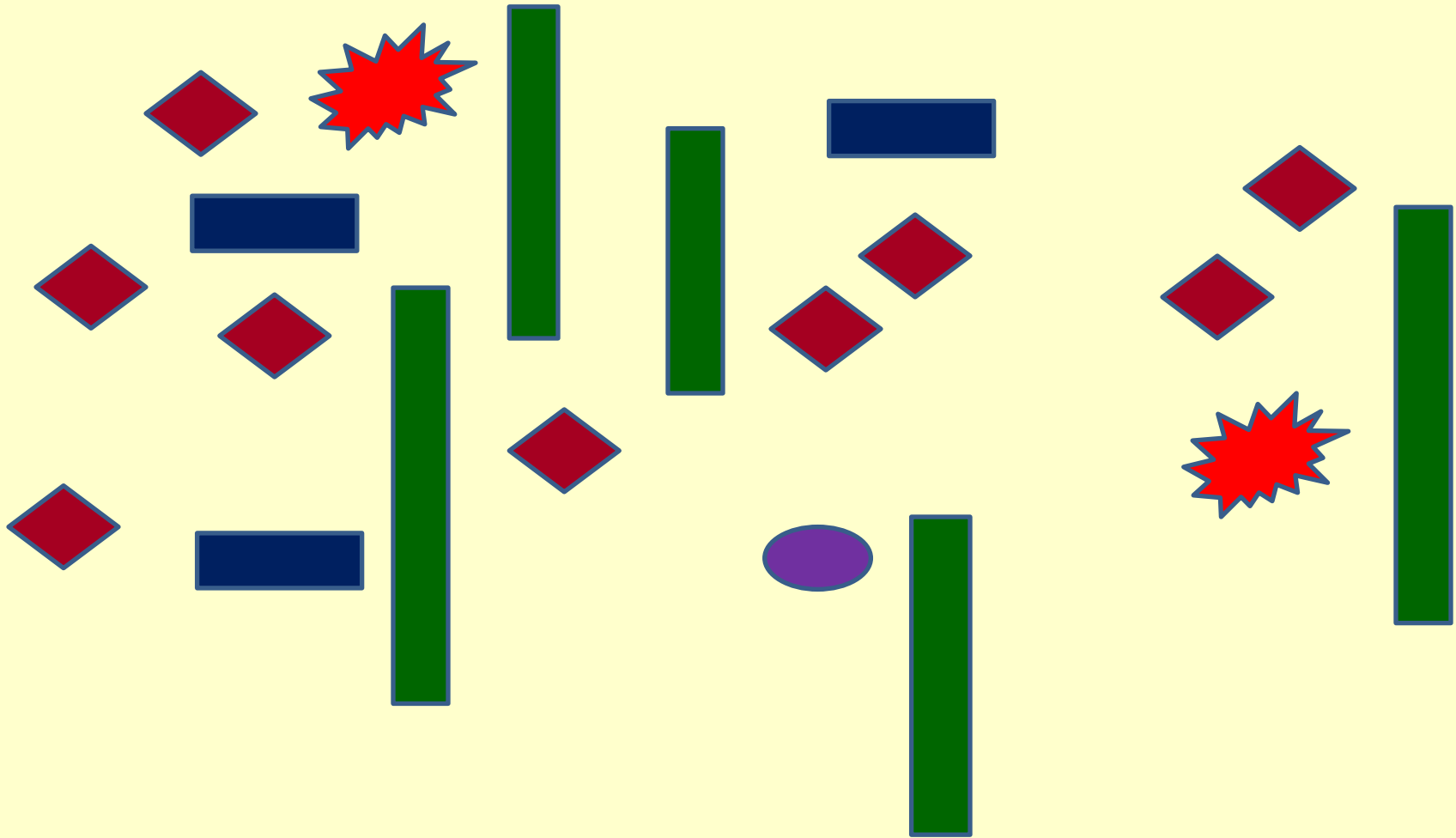
Coping by Elimination 2



Focus within Simplification



Returning other Elements to View



Roots of our Need for Theories

why need

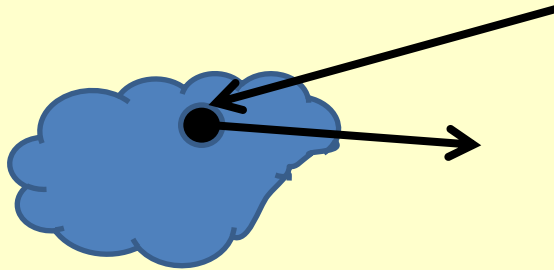
theories &
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1. Time Crunch: mentioning every detail of what has happened takes at least as long as the events themselves
2. Cognitive Limitation: human ability to process incoming information is lower than flow of incoming information
3. Two-track brains: coexistence of easy to use “fast” and harder to use “slow” thinking systems

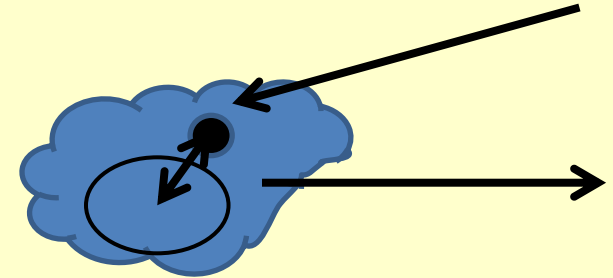
Fast and Slow Thinking Systems

Fast System



“instinct”
learned routines
immediate response

Slow System



conscious thought
slower response

distinction from Daniel Kahneman, *Thinking Fast and Slow* (2011)

What is a Theory?

A mental conception that includes

concepts defining things and processes

statements about relations between
things and/or processes

statements about the type of relation
between things and/or processes

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Example: Gravity

key concepts: inertia, mass, force, object

example statement of relation:

tides are caused by the force exerted on
the Earth by the Moon's mass

example statement about type of relation:

the force is not constant; it varies with
-- the distance between Moon and Earth
-- the angle of alignment between the Moon
and the Sun

What is a Theory?

Statements about the world

“As-if”

the concepts are correct descriptions

the statements of relation are true

the statements about type of relation
accurately indicate the dynamics of
the relation

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What is a Model?

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A verbal, mathematical, or visual
depiction indicating how

a particular process operates
and/or

a particular outcome is produced

Example: Motion of the Planets

ancient: Earth is at the center point; Sun, Moon, planets and stars revolve around the Earth in their different circular orbits

Copernicus 1543: Sun is at the center point ; Earth, planets, and stars revolve around the Sun in their different circular orbits

Kepler 1609: Sun is in the center; Earth and planets revolve around the Sun in elliptical orbits; Sun is at one of the ellipse's two nodes

Theories and Models

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Models can exist without theories:
they can be figured out by **induction** from
observations

Copernicus and Kepler offered **models**

Newton, *Philosophiæ naturalis principia mathematica (Mathematical Principles of Natural Philosophy)* 1687 provided a **theory** explaining why Kepler's model was superior -- and also led to improving it.

Theories and Models

Theories can be used to create models:
use **deduction** from concepts and relation
statements to depict processes

Economic theory supports 2 models of how
inflation get started:

cost-push

demand-pull

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Uses of Theories

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develop models of processes or of the
causal mechanisms yielding outcomes

understand the world

anticipate the future

seek improvements

Uses of Theories

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all this works only if we

avoid oversimplification

have good assumptions

use up-to-date knowledge to build
theories and models

Your Task

why need

theories &
models

bad & good
theories

become aware of the theories and models
already in your brain

-- especially the fast thinking part

compare them to other theories and
models

improve what you keep in your brain