Why We Need Theories V.2

M.J. Peterson, University of Massachusetts - Amherst
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Why We Need Theories

M.J. Peterson
Department of Political Science
Thompson Hall
mjp@polsci.umass.edu

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

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

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
Focusing within the larger Picture
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

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
Example: Gravity

key concepts: inertia, mass, force, object

element statement of relation:
  tides are caused by the force exerted on
  the Earth by the Moon’s mass

element 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

why need theories & models

bad & good theories
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

Why need theories & models? They can be figured out by induction from observations.

Copernicus and Kepler offered models.
Models can exist without theories: they can be figured out by **induction** from observations.

Copernicus and Kepler offered **models**.

Newton, *Philosophiae 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.
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
Uses of Theories

why need theories & models

bad & good theories

develop models of processes or of the causal mechanisms yielding outcomes

understand the world

anticipate the future

seek improvements
why need theories & models

bad & good theories

all this works only if we avoid oversimplification have good assumptions use up-to-date knowledge to build theories and models
Your Task in College

why need theories & models

become aware of the theories and models already in your brain

bad & good theories
Your Task in College

why need theories & models

bad & good theories

become aware of the theories and models already in your brain

-- especially the fast thinking part because it operates so quickly
Your Task in College

- why need theories & models
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compare them to other theories and models
Your Task in College

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compare them to other theories and models

improve what you keep in your brain