Dual-Process Theories: Questions and Outstanding Issues

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Why do we need Dual Process Theories?
- Integrate with each other, cognitive theories

Integration with existing models, paradigms
- Predictive power, verify assumptions
- Representing the problem space
- Start and stop rules for “System 2”

Distributed role for “Systems 1 and 2”

Need for Dual Process Theories?
Why do we need DPT?

- Confirmation bias
- Belief bias
- Base-rate neglect
- Pseudodiagnosticity
- Positive testing
- Framing
- Explanation-based reasoning

- Illusory correlation
- Gambler’s fallacy
- Hindsight bias
- False consensus
- Conjunction fallacy
- Anchoring
- Fundamental attribution error
Need for Integration

- Shopping list approach impedes general theory (Krueger & Funder, 2004)
  - Unique explanations, seldom integrated with each other much less broader theories of cognition

- Dual Process Theories
  - Integrate explanations with each other
  - Less integration with cognitive theory
    - Descriptions of processes and representations vs principles
    - Lack sufficient precision for prediction

- Intermediate Level of Theorising
  - Link to theoretical frameworks in Cognition
  - Paradigms for investigation
Heuristic Analytic Theory

(Evans, in press)

- Assumptions
  - Heuristic precede analytic
    - Formulate model
  - Analytic processes
    - Engaged if model does not satisfy
Heuristic Processes

Analytic Processes

Task Features
- Construct most plausible or relevant model

Current Goal

Background Knowledge

Instructional set

General Intelligence

Time Available

Analytic system Intervention?

Explicit reasoning and evaluation processes

Yes

No

Inferences/Judgments

Does model Satisfy?

No

Yes
Heuristic Processes

Analytic Processes

Construct most plausible or relevant model

Analytic system Intervention?

Inferences/Judgments

 Explicit reasoning and evaluation processes

Does model Satisfy?

Task Features
Current Goal
Background Knowledge
Instructional set
General Intelligence
Time Available

Yes

No

Yes

No
A problem of widgets

If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets?

____ minutes

If it takes 5 machines 2 minutes to make 10 widgets, how long would it take 100 machines to make 100 widgets?

____ minutes
Heuristic Analytic Theory

(Evans, in press)

- Assumptions
  - Heuristic precede analytic
    - Formulate model
  - Analytic processes
    - Engaged if model does not satisfy

- Predictive Power
  - Which cues are pragmatically relevant?
    - Link between representation and process
  - Start and stop rules for System 2
    - Characteristics of problems, situations
Heuristic Processes

Analytic Processes

Task Features
Current Goal
Background Knowledge
Instructional set
General Intelligence
Time Available

Construct most plausible or relevant model

Analytic system
Intervention?

Yes

Explicit reasoning and evaluation processes

No

Does model Satisfy?

Yes

Inferences/Judgments
Principles of Model Building

- Derive meaning
  - Contextualization, e.g.,
    - Priming
      - Conditional reasoning (many)
      - Analogical reasoning (Fugelsang et al, in press)
      - Anchoring and adjustment (Chapman & Chapman, 2002)
  - Categorization/ Stereotyping
  - Emotion
  - Pattern recognition, extraction
Principles of Model Building

- Feature Positive (Hearst, 1991)
  - Attention, Learning
    - Presence vs absence of features, appearance vs disappearance of objects
    - Conditioning
Stueben (1987)
Principles of Model Building

- Feature Positive (Hearst, 1991)
  - Attention, Learning
    - Presence vs absence of features, appearance vs disappearance of objects
    - Conditioning
  - Representation
    - Represent present rather than absent
      - May omit relevant
    - Consistent with information provided
      - Syllogisms
Principles of Model Building

- Feature Positive (Hearst, 1991)
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      - Syllogisms

- Phenomena
  - Causal judgment, positive testing, base rate neglect, availability, matching bias etc.
Heuristic Processes

Task Features
- Current Goal
- Background Knowledge

Analytic Processes

Construct model: Context, feature positive

Explicit reasoning and evaluation processes

Analytic system Intervention?

Does model Satisfy?

Inferences/Judgments
Natural Assessments
(Kahneman & Frederick, 2002)

- Attributes that are routinely evaluated as part of perception and comprehension
  - Physical attributes
    - Size, distance, loudness
  - Abstract attributes
    - Affective valence, belief, similarity, recognition, surprise, etc
    - Heuristic judgment
    - Expert judgment
Heuristic Processes

Analytic Processes

Task Features
Current Goal
Background Knowledge

Construct model:
Context, feature positive

No

Natural Assessment?

Yes
After Natural Assessment: Feeling of Rightness (FOR)

- Feeling of Rightness (FOR)
  - Metacognitive judgment
    - e.g., Feeling of Familiarity (FOF)
    - Basis: fluency, cue familiarity, metacognitive theory, others???

- Determines degree and type of S2 intervention
Analytic Processes

Task Features
Current Goal
Background Knowledge

Construct model: Context, feature positive

No
Natural Assessment?
Yes

Feeling of Rightness

Fluency
Familiarity
Theory

Accept Nat. Assess.
Justify Nat. Assess.
Reformulate Model

Heuristic Processes
Metacognitive Processes
Analytic Processes
Without a Natural Assessment
Feeling of Solvability (FOS)

- Feeling of Solvability (FOS)
  - Metacognitive Judgment
    - e.g., Feeling of Knowing (FOK)
    - Basis- perceived complexity, familiarity??
    - Expertise

- Determine degree of effort engaged by S2
  - FOR (Confidence?)
  - Basis?
Analytic Processes

<table>
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<th>Task</th>
<th>Features</th>
<th>Current Goal</th>
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- **Construct model:** Context, feature positive

- **Feeling of Solvability**
  - Complexity
  - Familiarity
  - Expertise

- **Natural Assessment?**
  - Yes
    - Feeling of Rightness
      - Fluency
      - Familiarity
      - Theory
    - Accept Nat. Assess.
    - Justify Nat. Assess.
    - Reformulate Model
  - No
    - Give up/
      Attempt solution
      - Instruction
      - Set
      - General Intelligence
      - Time
Dual Process Theory???

- Changes to assumptions
  - “Systems” distributed
    - Implicit/ explicit processes may play a role at many different points
    - There are many types of “heuristic” and “analytic” processes
  - Integrate theories and paradigms from other disciplines
    - Predictive power, verify assumptions
    - Identify assumptions and processes that require further investigation

- Need for original assumptions?
  - Automatic and controlled processes
    - Automatic processes “Ballistic”
    - Anchoring and failure to adjust
Next Steps

- Framework for asking questions
  - Link to broader cognitive theory
  - Verify and test putative processes

- Representation
  - Contextualization
    - Link between representation and judgment
    - Conditional Reasoning

- Metacognitive Judgments
  - Memory analogy limited
  - Determinants of FOR, FOS
    - Predict and Measure

- Expert Judgment
How fast can you spot what is unusual about this paragraph? It looks so ordinary that you might think nothing was wrong with it at all and, in fact, nothing is. But it is atypical. Why? Study its various parts, think about its curious wording, and you may hit upon a solution. But you must do it without aid; my plan is not to allow any scandalous misconduct in this psychological study. No doubt, if you work hard on this possibly frustrating task, its abnormality will soon dawn upon you. You cannot know until you try. But it is commonly a hard nut to crack. So good luck!

I trust a solution is conspicuous now. Was it dramatic and fair, although odd? *Author’s hint:* I cannot add my autograph to this communication and maintain its basic harmony.
Natural Assessment (Heuristic)

FOR

System 2

Nat. Assess
Justify
Re-evaluate

No Natural Assessment (Analytic)

FOS

System 2

Don’t know
Answer (FOR)
Re-evaluate

IQ, WM
Singularity
Instructions
Time