


Thinking 2

Dual-Process Theory

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- **Heuristics:** Strategies that can be used in all kinds of directed thinking to quickly make judgments, decisions, reason, or solve problems, at the price of occasional errors.
- Which of the following statements is correct
 - A. The *availability* heuristic is invoked in situations that involve categorization and the *representativeness* heuristic is invoked in situations that involve frequency assessments.
 - B. The *representativeness* heuristic is invoked in situations that involve categorization and the *availability* heuristic is invoked in situations that involve frequency assessments.
 - C. Both the *availability* and the *representativeness* heuristics are examples of System 2 thinking.
 - D. We would be better off if we could avoid ever using either the *availability* or the *representativeness* heuristics.

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Dual-Process Theory

- **System 1: Intuitions & Heuristics**
 - Automatic & Effortless
 - Typically we are unaware of cues
 - Based on prior knowledge and beliefs
- **System 2: Effortful reasoning**
 - Intentional; requires effort
 - Can arrive at outcomes contrary to expectations
 - Results can be explained
- **May work in parallel**
 - System 2 processes monitoring System 1


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- Can you reliably distinguish dogs and cats?

- A. Yes
- B. No
- C. Not sure

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- Can you describe the cues you use to distinguish all dogs from all cats?

- A. Definitely Yes
- B. Not Sure
- C. Definitely No


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- What is this?

- A. Dog
- B. Cat
- C. Not Sure

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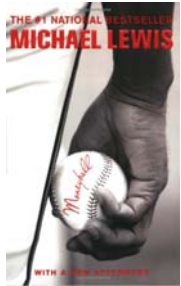
- A pen and pencil together cost \$1.10. The pen costs a dollar more than the pencil. How much does the pencil cost?
- A. 1 cent
- B. 5 cents
- C. 10 cents
- D. 15 cents

➔

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System 1 Errors: Incorrect Intuitions

- *Moneyball* described the weaknesses in the ability of baseball scouts and managers to judge the capabilities, contributions, and potential of players
 - Representativeness heuristic




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Anchoring Effects (Mussweiler & Strack, 2000)

Example of Availability Heuristic

A. Is the average cost of German cars more or less than \$100,000?


Mercedes, BMW, Audi



Estimate A

B. Is the average cost of German cars more or less than \$30,000?

Volkswagen, Smart Car




Estimate B

➔

What is an estimate of the average cost of German cars?

These differing estimates are made confidently and without awareness of the effects of the anchor.

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- Julie is a recent UCI graduate. She read fluently at age 4. What is your best guess of her UCI GPA?
- A. 3.5 – 4.0
- B. 3.0 – 3.5
- C. 2.5 – 3.0
- D. 2.0 – 2.5
- E. Below 2.0

Explanation: Attribute substitution

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Factors that Encourage Using System 2 Thinking

- Being rested and unstressed
- Stating problems using frequencies rather than probabilities
- Evidence that is more easily quantified
- Courses that teach or encourage thinking about and with numbers and sampling

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System 2 Reasoning Associated with WM Capacity

- Across participants, people with more working memory capacity (WM) use System 2 thinking more frequently
- Correlational research
- Which raises an *internal validity* question
 - Does System 2 thinking depend on WM
 - Do people with better WM also have other differences that make them more capable of System 2 thinking?

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Syllogisms

- **Syllogism**: is a form of **logical argument** that uses **deductive reasoning** to arrive at a **conclusion**
 - based on two or more **premises** that are assumed to be true
- A syllogism is **valid** if the conclusion **follows logically** from the premises
- A syllogism is analogous to an arithmetic identity: e.g. $3 + 2 = 5$

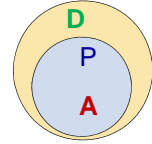
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Syllogisms: An Example

- Premise 1: all **P** are **D**
 Premise 2: **A** is a **P**.
 Conclusion: **A** is **D**
- Premise 1: all **Poisons** are **Dangerous**.
 Premise 2: **Arsenic** is a **Poison**.
 Conclusion: **Arsenic** is **Dangerous**



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Validity of a Syllogism is NOT the Same as the Truth of the Conclusion

- Premise 1: all **P** are **D**
 Premise 2: **A** is a **P**.
 Conclusion: **A** is **D**
- Premise 1: all **People** are **Dragons**.
 Premise 2: **Adults** is a **People**.
 Conclusion: **Adults** are **Dragons**.
- The **syllogism is valid** even though the **conclusion is false**
 - The conclusion can be false because the first **premise is false**.

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Syllogisms can be Invalid

- There are 256 possible ways to construct a syllogism, but only 24 of these are valid
- Analogy: invalid arithmetic identities $1 + 3 = 5!$

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Why Syllogisms Matter

- Evaluating arguments
 - If we recognize an argument to have one of the 24 valid forms
 - And we are confident of the premises
 - We can be confident of the conclusion
- Once thought to model all rational thought

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Consider this syllogism

- Premise 1: All things that are smoked are good for the health.
 Premise 2: Cigarettes are smoked.
 Conclusion: Cigarettes are good for the health.

- A. The syllogism IS valid
- B. The syllogism IS NOT valid
- C. Not sure

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■ Consider this syllogism

Premise 1: All flowers have petals.
 Premise 2: Roses have petals.
 Conclusion: Roses are flowers.

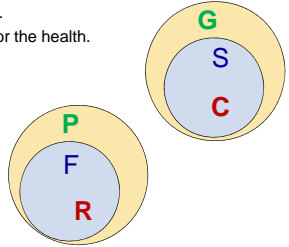
A. The syllogism IS valid
 B. The syllogism IS NOT valid
 C. Not sure

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Syllogisms With Belief Conflicts

Premise 1: all things that are Smoked are Good for the health.
 Premise 2: Cigarettes are Smoked.
 Conclusion: Cigarettes are Good for the health.

Premise 1: all Flowers have Petals.
 Premise 2: Roses have Petals.
 Conclusion: Roses are Flowers.



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De Neys (2006): WM and System 1 vs. 2 Reasoning

2 Types of Syllogism Working Memory Load
 High Low None

No Conflict
 Meaning matches validity

With Conflict
 Meaning conflicts with validity

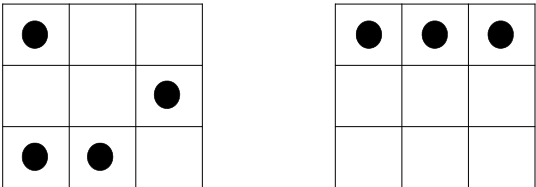
No Effect

• Memory span was measured and used to divide the 308 participants into 3 groups

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De Neys(2006): Memory Load Manipulation

High Low



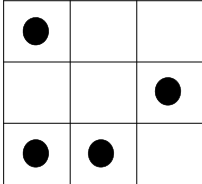
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De Neys(2006): Task

Premises: All fruits can be eaten.
 Hamburgers can be eaten.
 Conclusion: Hamburgers are fruits.

1. The conclusion follows logically from the premises.
 2. The conclusion does not follow logically from the premises.

Type down the number that reflects your decision: _



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De Neys(2006): Task

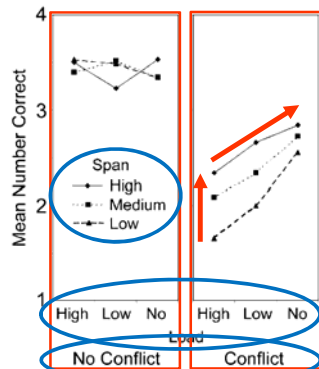
Each participant answered 8 syllogisms

	Valid	Not Valid
Without Conflicts	2	2
With Conflicts	2	2

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De Neys(2006): Results

- There was not a load effect for the *No Conflict* syllogisms
- For the *Conflict* syllogisms
 - More correct answers with decreasing WM load
 - More correct answers with increasing Memory Span (WM capacity)
- Manipulation of memory load increase internal validity



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Summary: Dual-Process Theory

- System 1 Thinking
 - Based on heuristics: e.g., representativeness and availability
 - Fast, but occasionally misleading
- System 2 Thinking
 - More careful, slow, and effortful
 - More accurate; can lead to *new* conclusions
- Stress, framing, and education all alter the frequency of System 2 thinking
- Correct use of System 2 depends on available WM
 - Distraction (multitasking) interferes with System 2
 - WM declines with aging
 - Training WM?

Looking Ahead

- For Wednesday
 - Gleitman: Ch. 9, pp. 354-358
 - Zap #13: Wason Selection Task
- Coffee?



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