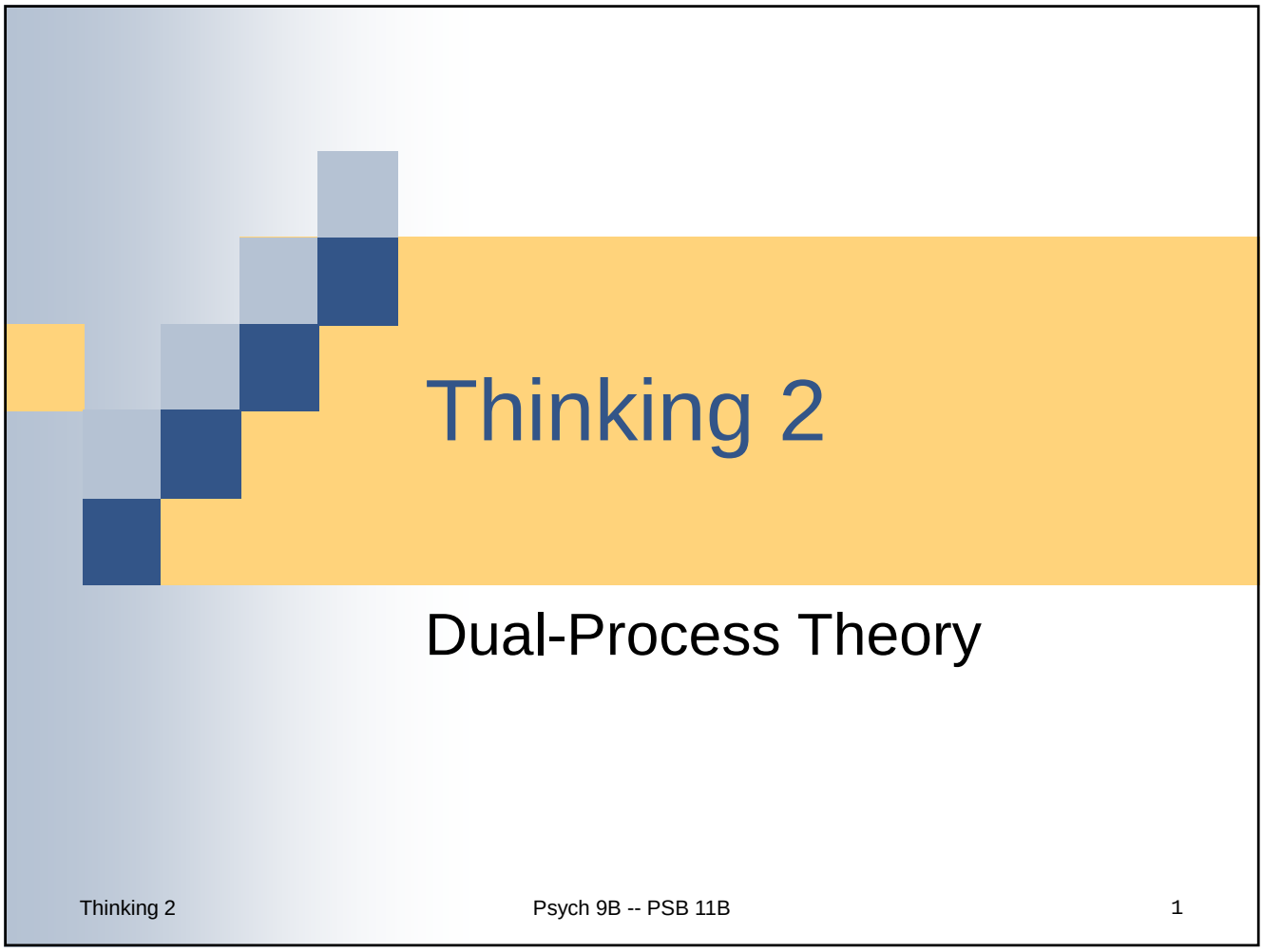

Thinking 2
Dual-Process Theory
Thinking 2
Psych 9B -- PSB 11B
1

- ***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.

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

- Can you reliably distinguish dogs and cats?

A. Yes
B. No
C. Not sure

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

A. Definitely Yes

B. Not Sure

C. Definitely No

- What is this?

A. Dog

B. Cat

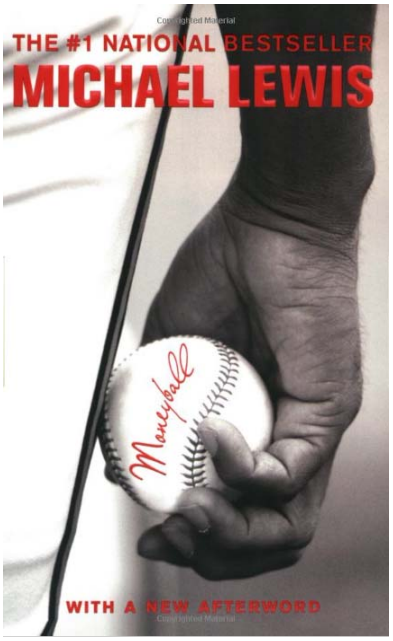
C. Not Sure

- 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

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



Anchoring Effects (Mussweiler & Strack, 2000) Example of Availability Heuristic

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

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

Mercedes, BMW, Audi

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

Volkswagen, Smart Car

Estimate A > Estimate B

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

- 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

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

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?

Syllogisms

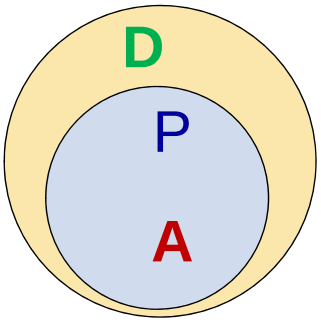
- **Syllogism:** is a form of logical argument that uses deductive reasoning to arrive at a conclusion
  - based on two or more premises that are assumed to be true
- A syllogism is valid if the conclusion follows logically from the premises
- A syllogism is analogous to an arithmetic identity: e.g.

  3 + 2 = 5

Syllogisms: An Example

Premise 1: all **P** are **D**
Premise 2: **A** is a **P**.

Conclusion: **A** is **D**



Premise 1: all **P**oisons are **D**angerous.
Premise 2: **A**rsenic is a **P**oison.

Conclusion: **A**rsenic is **D**angerous

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 **P**eople are **D**ragons.
Premise 2: **A**dults is a **P**eople.

Conclusion: **A**dults are **D**ragons.

- The syllogism is valid
  even though the conclusion is false
- The conclusion can be false
  because the first premise is false.

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!

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

- Consider this syllogism

Premise I: 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

- Consider this syllogism

  Premise I: All flowers have petals.

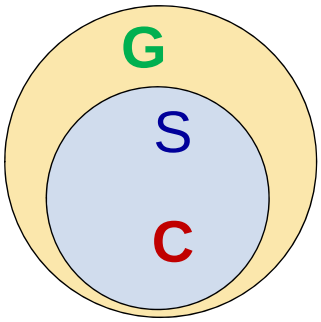
  Premise 2: Roses have petals.

  Conclusion: Roses are flowers.

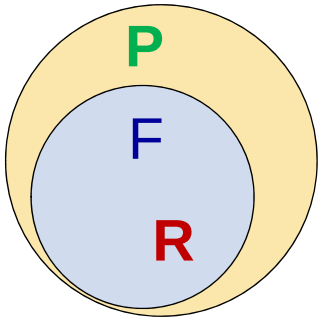
A. The syllogism IS valid
B. The syllogism IS NOT valid
C. Not sure

Syllogisms With Belief Conflicts

Premise I: all things that are **S**moked are **G**ood for the health.
Premise 2: **C**igarettes are **S**moked.
Conclusion: **C**igarettes are **G**ood for the health.



Premise I: all **F**lowers have **P**etals.
Premise 2: **R**oses have **P**etals.
Conclusion: **R**oses are **F**lowers.



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

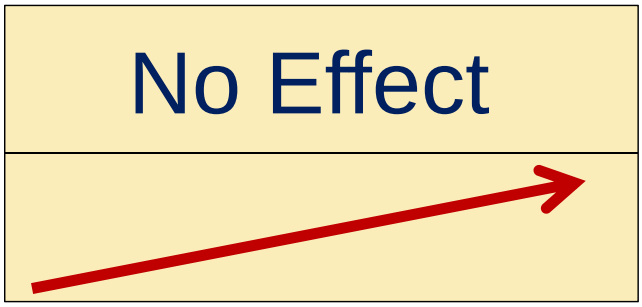
2 Types of Syllogism

Working Memory Load

High Low None

No Conflict
Meaning matches validity

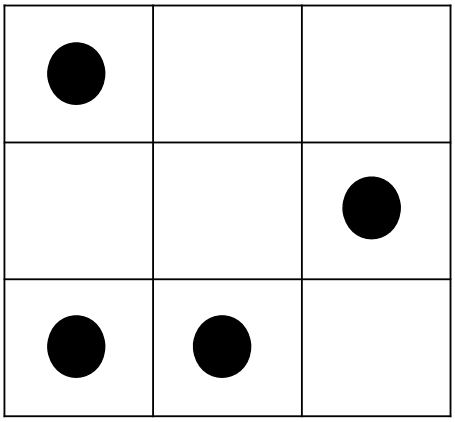
With Conflict
Meaning conflicts with validity



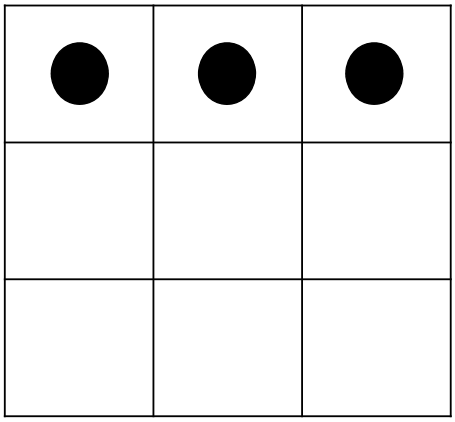
- Memory span was measured and used to divide the 308 participants into 3 groups

De Neys(2006): Memory Load Manipulation

High



Low

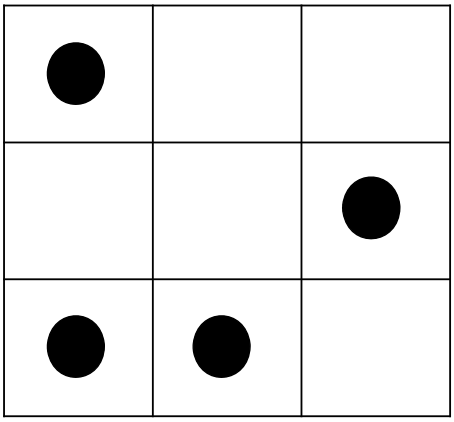


De Neys(2006): Task

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: _



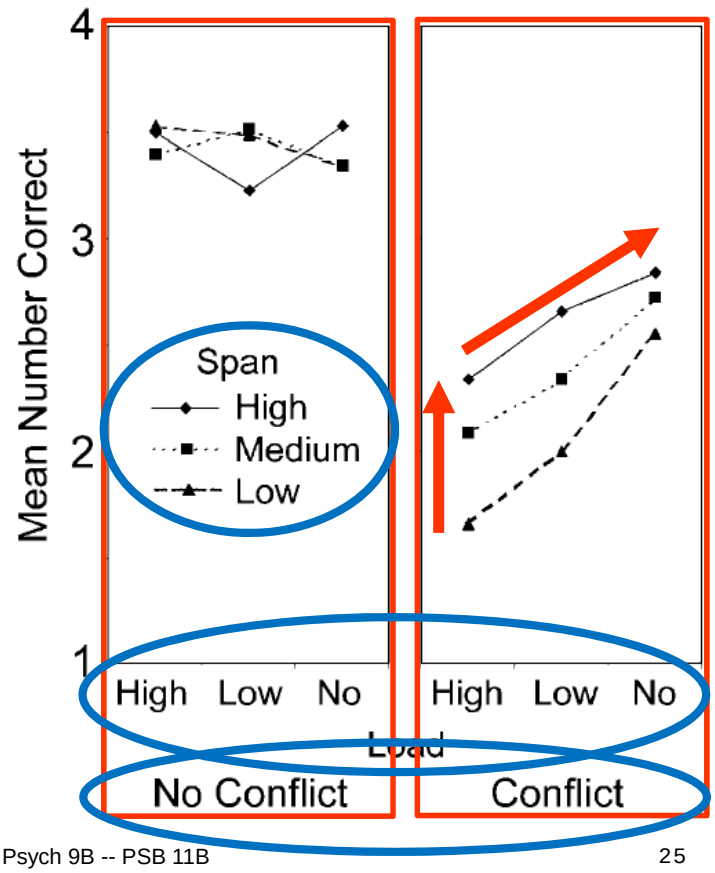
De Neys(2006): Task

Each participant answered 8 syllogisms

	Valid	**Not Valid**
Without Conflicts	2	2
With Conflicts	2	2

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



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?