

The Marvels and the Flaws of Intuition

IPMU

July 4, 2006

Outline

- ❖ Marvels
- ❖ Flaws
- ❖ A two-system view
 - System 1 – an extension of perception
 - System 2 – a slower reasoning device
- ❖ Functions of System 2:
 - monitoring
 - explicit computations
- ❖ Two critical features of System 1:
 - Attribute substitution
 - Improper evaluation by prototype

Background:

Two ways thoughts come to mind

One way thoughts come to mind

17 x 24 is

One way thoughts come to mind

17 x 24 is 408

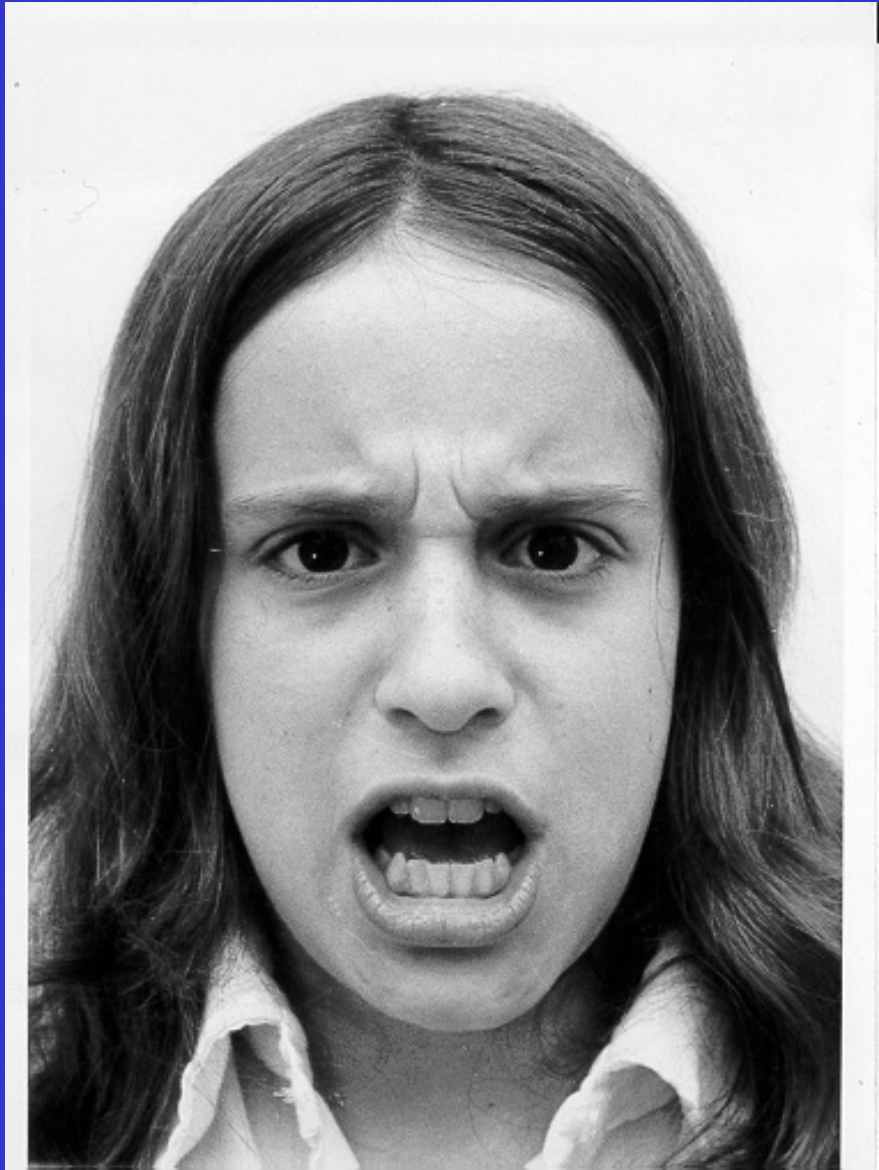
One way thoughts come to mind

17 x 24 is 408

- ❖ A sequential computation, governed by a rule

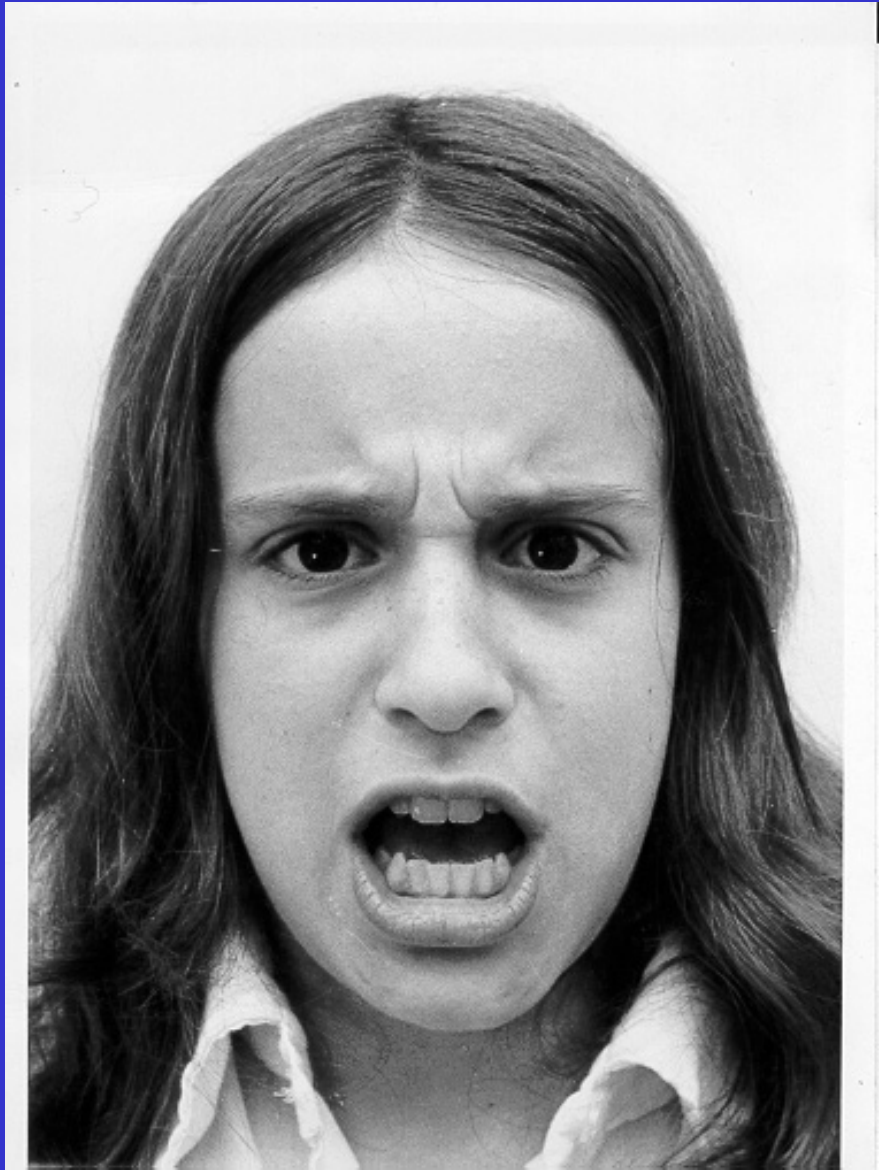
Another way thoughts come to mind

Another way thoughts come to mind



is

Another way thoughts come to mind



is angry

The accessibility dimension

The accessibility dimension

High accessibility

Perceptual impressions

Products of deliberate computations

Low accessibility



On one hand: The marvels of intuition

❖ A currently 'hot' topic

- Malcom Gladwell's 'Blink'

❖ Chess players and other masters

- Herbert Simon's pattern recognition model

❖ Naturalistic Decision Making

- (Gary Klein: *Sources of Power*)
- deciding without conscious choice
- "recognition-primed decision making"

❖ Pre-conscious emotional learning

- "somatic markers" (Damasio & Bechara)
- direct activation of emotion (LeDoux)

Conditions for expertise

❖ Prolonged practice

- rapid and unequivocal feedback for pattern learning

❖ Reliable signals of threats or opportunities

- emotional learning from experience
- emotional learning from warnings

The other hand: Error and Overconfidence

- ❖ **Clinical vs statistical prediction** (Meehl, 1954)
 - confidence without accuracy
 - inefficient weighting of information (the interview)
 - neglect of base rate information
- ❖ **Jumping to statistical conclusions**
 - “The Law of Small Numbers” (Tversky-Kahneman, 1971)
 - intuitions were wrong, even for familiar material
- ❖ **Political and economic forecasts** (Tetlock)
 - little or no success in medium-term forecasts
 - little ability to learn from mistakes

Theory

❖ **Needed: a view of the mind that accommodates**

- intuitive thought --- deliberate computation
- intuitive expertise --- cognitive illusions

❖ **A two-system model – increasingly accepted**

- Intuition --- System 1
- Reasoning --- System 2

❖ **Many authors have advanced 2-system models:**

- Epstein, Evans and Over, Sloman, Stanovich & West

INTUITION
System 1

Fast
Parallel
Automatic
Effortless
Associative
Slow-learning
Emotional

REASONING
System 2

Slow
Serial
Controlled
Effortful
Rule-governed
Flexible
Neutral

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Most judgments and actions are governed by System 1, unproblematic, skilled, and adequately successful

Products of System 1: Natural assessments

- ❖ *Computations that are carried out routinely, always accessible* (Tversky and Kahneman, '83)
- ❖ Many properties of objects are perceived without any *intention*, and without much (or any) *attention*
- ❖ The processing of more abstract information also involves natural assessments

Natural assessment of an insurance policy

- (A) a policy that pays \$50,000 in case of death due to terrorism
- (B) a policy that pays \$50,000 in case of death for any reason

When people consider each policy in isolation

they are willing to pay much more for insurance against terrorism

Blocking a Natural Assessment

- ❖ **When people are given a direct choice**
 - they normally notice the inclusion relation and make the correct choice
- ❖ **The tendency to make the error still exists**
 - but System 2 controls the final response
- ❖ **A dichotomy of experimental designs**
 - Between-subjects vs Within-subject**
 - Between-subjects experiments more likely to reveal System-1 thinking
 - Errors and biases more likely to be avoided in within-subject designs, which invokes System 2
- ❖ **Between-subjects designs often more realistic**

The effort diagnostic

- ❖ Susceptibility to interference by concurrent activity is a diagnostic of System 2 operations

Monitoring and correction

- ❖ Most cognitive activity is relatively effortless. Most judgments and decisions are intuitive.
- ❖ But we don't say (or seriously think) everything that comes to mind. Cognitive operations are monitored, and judgments are sometimes corrected or replaced in an effortful operation,

Frederick's "bat-and ball" problem

- ❖ "A bat and a ball together cost \$1.10. The bat costs a dollar more than the ball. How much does the ball cost?"
- ❖ 50% of a group of Princeton students failed
- ❖ ***Monitoring is 'light'. Most judgments and decisions are based on impressions generated by System 1***
- ❖ When people are cognitively busy, monitoring fails

An evolutionary speculation

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PERCEPTION

INTUITION
System 1

REASONING
System 2

PROCESS

Fast
Parallel
Automatic
Effortless
Associative
Slow-learning
Emotional

Slow
Serial
Controlled
Effortful
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Neutral

CONTENT

Percepts
Current situation
Stimulus-bound

Conceptual representations
Past, Present and Future
Can be evoked by language



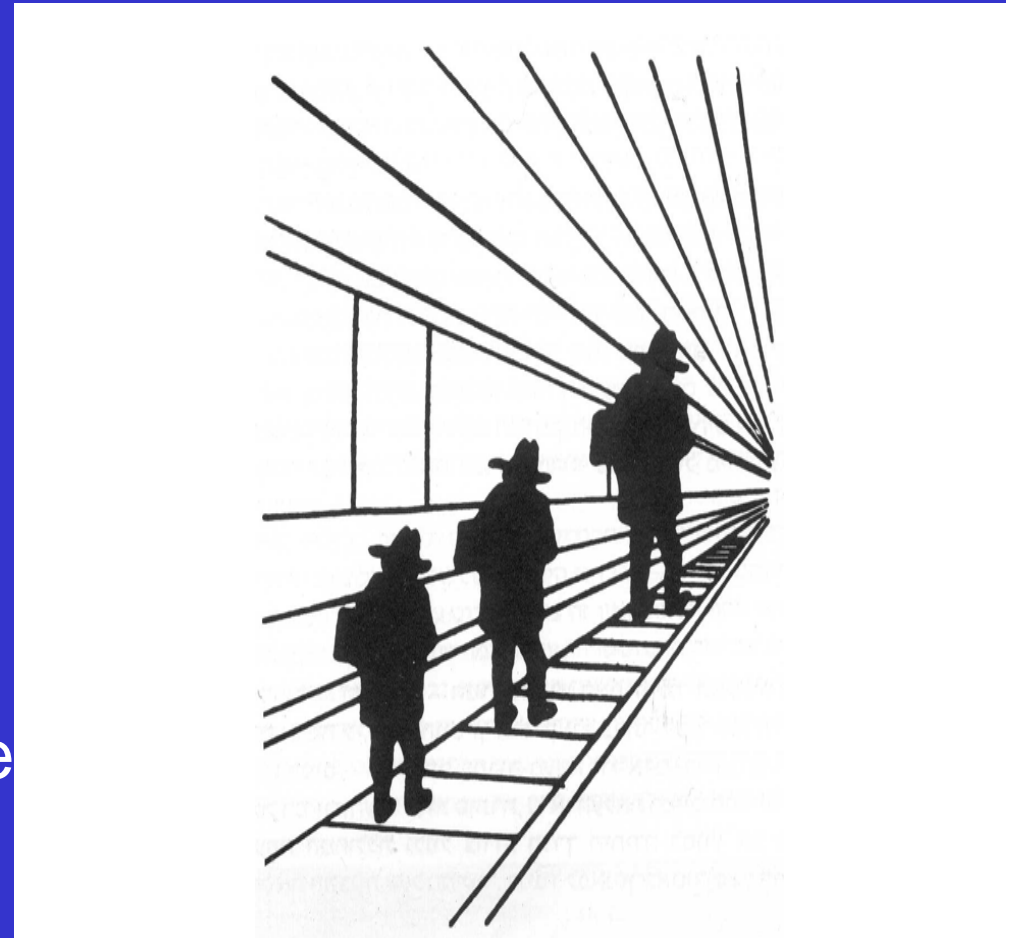
Attribute substitution:

A general heuristic of judgment

Answer a difficult question by answering
an easier one

A perceptual illusion of attribute substitution

- ❖ What is the size of the figures *on the screen*?
- ❖ They are of equal size
- ❖ The three-dimensional interpretation is much more accessible than the two-dimensional interpretation that is required



Attribute substitution in a survey

- ❖ Students were asked
 - “How happy are you?”
 - “How many dates did you have last month?”
- ❖ The correlation between the answers was $-.12$ (ns)
- ❖ When the dating question came first, the correlation was $.66$

- ❖ Did the students deliberately choose to evaluate their happiness by their romantic satisfaction?
- ❖ The answer just came to mind, and passes the loose monitoring of System 2
- ❖ In other situations, the value of the accessible attribute is used as an anchor, and adjusted
- ❖ Heuristics of judgment typically involve substitution of one task for another

The Linda problem

Illustrates the substitution of a highly accessible attribute (similarity) for a less accessible one (probability)

Linda is 31 years old, single, outspoken and very bright. She majored in philosophy. As a student she was deeply concerned with issues of discrimination and social justice and also participated in nuclear demonstrations.

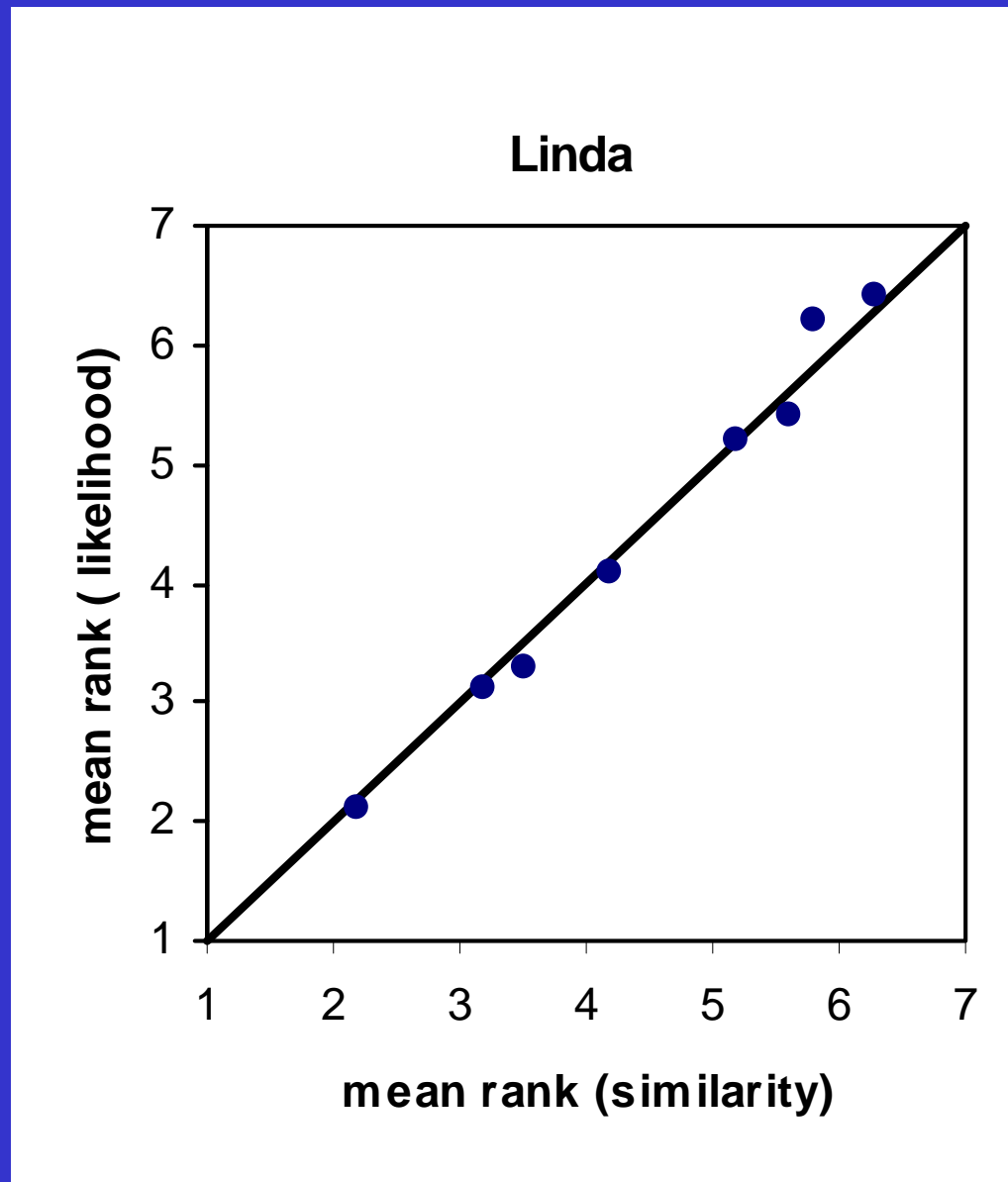
Different groups were shown this information,
and answered one of the following questions:

“Please rank the following possibilities by their probability” (low-accessibility, difficult)

“Please rank the following possibilities by the degree to which Linda resembles a typical member of the group” (intuitive, accessible)

- ___ a teacher in elementary school
- ___ works in a bookstore and takes yoga classes
- ___ an active feminist
- ___ a psychiatric social worker
- ___ a member of the Sierra club
- ___ **a bank teller**
- ___ an insurance salesperson
- ___ **a bank teller and an active feminist**

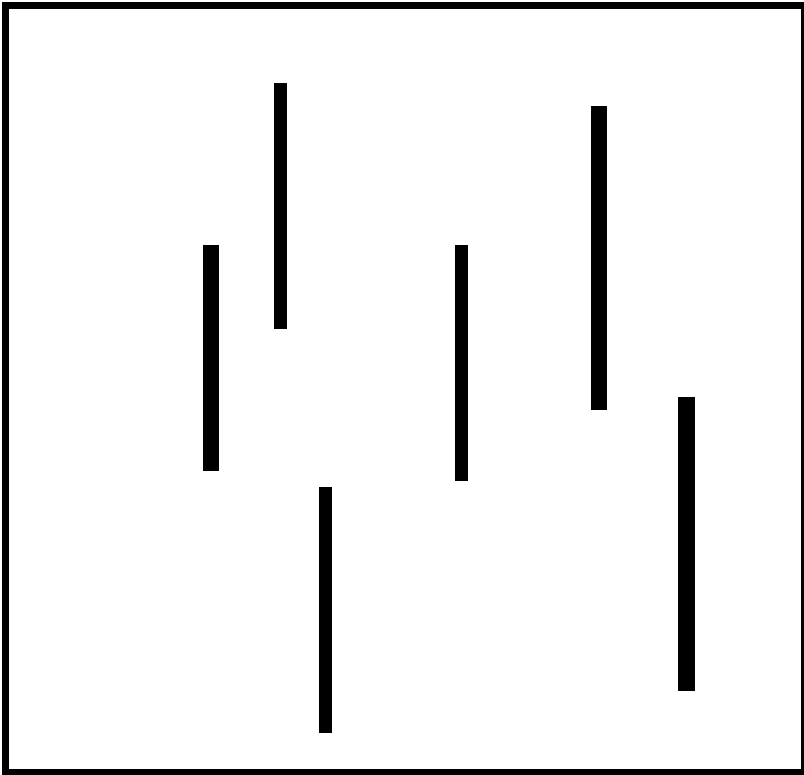
Direct evidence for attribute substitution

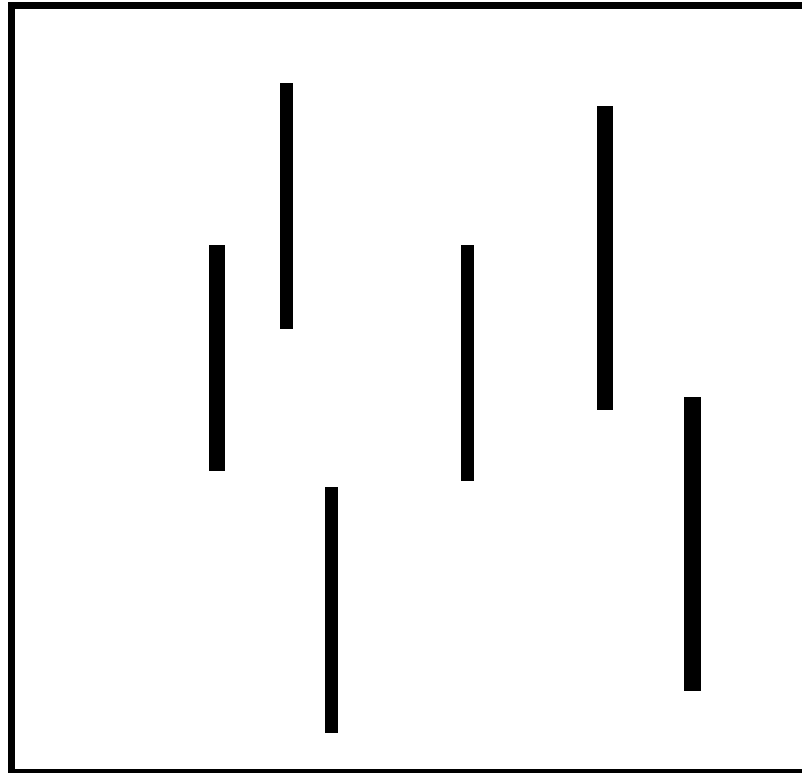


Blocking the error in the Linda problem

- ❖ Within-subject design usually insufficient
- ❖ Statistically sophisticated respondents respond correctly in a transparent within-subject design
- ❖ It is possible to provide other cues for System 2

Evaluation by Prototype



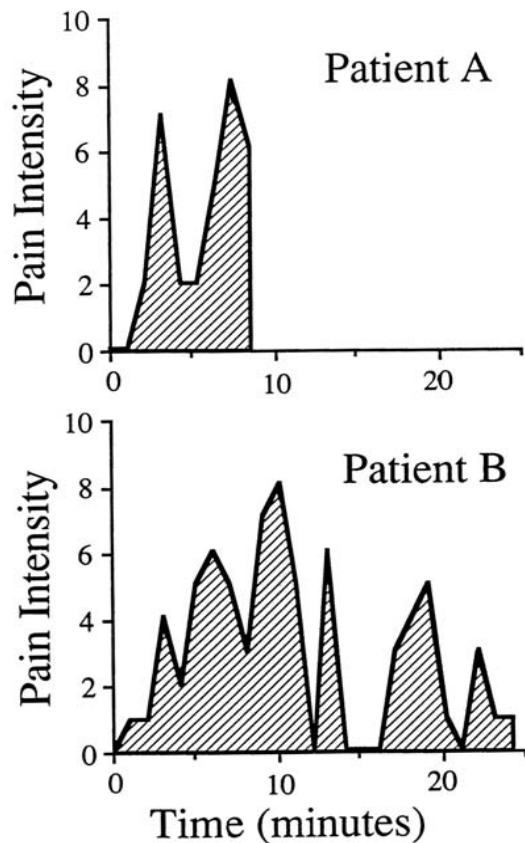


The average length is immediately accessible
The total length of the lines is not accessible

Substituting averages for sums

Evaluating an episode (set of moments)

Example 1: Patients undergoing colonoscopy reported their pain every 60 sec. (Redelmeier and Kahneman, 1996)



“How much did these patients suffer?”

There is a logical answer to the question: B suffered more

But the representation of an episode of pain is not a sum, but an average

The worst moment and the end of the episode are weighted most heavily in this average

As predicted, patient A reported more suffering than patient B

Choosing more pain

(Kahneman, Fredrickson et al, 1993)

On two trials, separated by seven minutes, participants immerse a hand in cold water until instructed to remove it. Seven minutes after the second trial, they are called for a third trial and are asked which of the two trials they want to repeat.

Short: 60 sec at 14°C

Long: 60 sec at 14°C + 30 sec → 15°C

65-80% prefer Long

This is not an isolated finding

Value of a dinner set (C. Hsee)

SET A (24 pieces)

8 dinner plates in good condition

8 salad bowls in good condition

8 dessert plates in good condition

❖ This set is worth \$33

SET B (40 pieces)

8 dinner plates in good condition

8 salad bowls in good condition

8 dessert plates in good condition

8 cups; 2 of them are broken

8 saucers; 7 of them are broken

- ❖ This set is worth \$23
- ❖ In joint evaluation, set B is worth more than set A
- ❖ JE provides an opportunity for System 2 to correct

What do these examples share?

- ❖ **System 1 operates on a non-extensional representation of a set of instances**
- ❖ **Questions that depend on extensional relations between sets will be answered incorrectly**
- ❖ **System 2 is better able to process extensional relations, especially if there are good cues**

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How Good is Intuition?

- ❖ **Marvelous**
- ❖ **Prone to illusions**
- ❖ **We will eventually understand it**

