

## LECTURE 6 DUAL SYSTEM

**Aim:** To introduce dual theories of mind and their implication for decision theory.

**Outline:** Kahneman's Nobel prize lecture. Dual systems. Attention and effort. The lazy controller.

### **Readings:**

Kahneman, D. (2003) "Maps of bounded rationality: psychology for behavioral economics", *The American Economic Review*, 93, 1449–1475.

Kahneman, D. (2011) *Thinking, Fast and Slow*, Farrar, Straus and Giroux, New York, chapt. 1-2-3.

### **Blogs, Videos and Websites:**

Prize Lecture by Daniel Kahneman (37:28)

<http://www.youtube.com/watch?v=5aG68FLYd9s>

# KAHNEMAN'S PROJECT

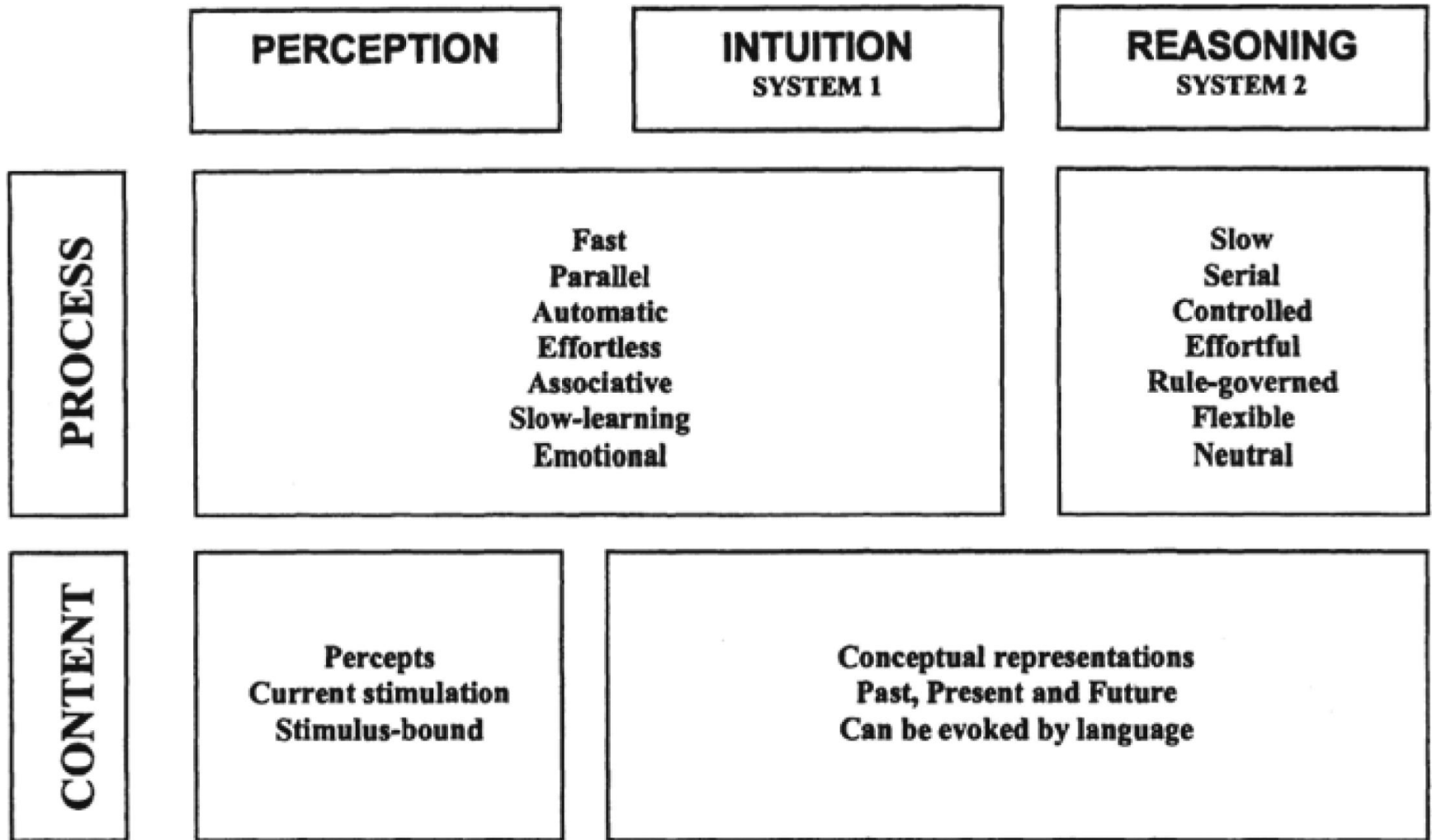
To explore the systematic biases that separate the beliefs that people have and the choices they make from the optimal beliefs and choices assumed in rational-agent economic models

intuitive judgment and choice  
vs.  
preferences and attitudes

## Model of judgment heuristics

### Key principles

- ▶ reasoning is done deliberately and effortful
- ▶ intuitive thoughts come spontaneously to mind without search, computation or effort
- ▶ most judgments and most choices are made intuitively
- ▶ rules that govern intuition are generally similar to the rules of perception



# SYSTEM 1 AND SYSTEM 2

- ▶ The perceptual system and the intuitive operations of System 1 generate **impressions** of the attributes of objects of perception and thought. These impressions are not voluntary and need not be verbally explicit.
- ▶ In contrast, **judgments** are always explicit and intentional, whether or not they are overtly expressed. Thus, System 2 is involved in all judgments, whether they originate in impressions or in deliberate reasoning.
- ▶ **Difference in effort** provides the most useful indications of whether a given mental process should be assigned to System 1 or System 2.
- ▶ **Intuitive judgments** occupy a position—perhaps corresponding to evolutionary history—between the automatic operations of perception and the deliberate operations of reasoning.

# SYSTEMS 1 AND 2 ACTIVITIES

## SYSTEM 1

Detect that one object is more distant than another

Complete the phrase "bread and..."

Make a "disgust face" when shown a horrible picture

Detect hostility in a voice

Answer to  $2+2=?$

Drive a car on an empty road

Find a strong move in chess (if you are a chess master)

Understand simple sentences

## SYSTEM 2

Focus attention on the clowns in the circus

Focus on the voice of a particular person in crowded and noisy rooms

Maintain a faster walking speed than is natural for you

Monitor the appropriateness of your behavior in a social situation

Tell someone your phone number

Park in a narrow space

Compare two washing machines for overall value

Check the validity of a complete logical argument

# SYSTEM 1 VS. SYSTEM 2

- ▶ The capabilities of System 1 include human skills that we share with other animals
- ▶ People are born prepared to perceive the world around us, recognize objects, orient attention, avoid losses, and fear spiders
- ▶ Other activities are learnt by System 1 by making associations between ideas (such as the master chess player)
- ▶ Many activities of System 1 are completely involuntary while others, such as chewing, are susceptible of voluntary control but normally run on automatic pilot (**accessibility**)
- ▶ System 2 is tuned to **pay attention** and has some ability to change the way system works by programming the normally automatic functions of attention and memory
- ▶ When you rent a car in UK you should pay attention to drive on the left side of the road

# HIGH AND LOW ACCESSIBILITY

the ease with which mental contents come to mind is *accessibility*

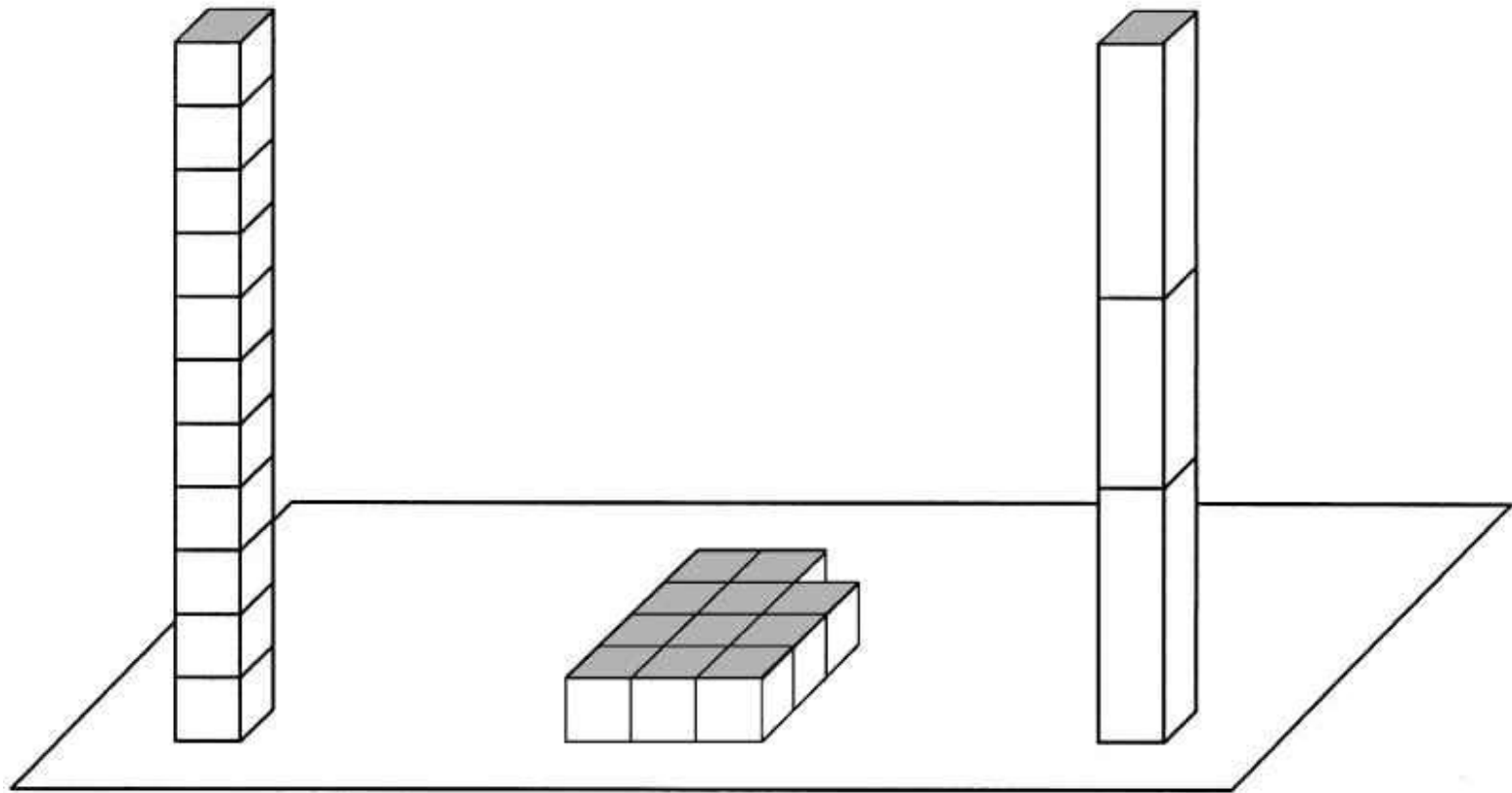


Figure 2a

Figure 2b

Figure 2c

# ACCESSIBILITY AND CONTEXT

A B C

D B A



# ACCESSIBILITY AND EXPECTATIONS

- ▶ **Expectations** (conscious or not) are a powerful determinant of accessibility.
- ▶ Ambiguity and uncertainty are suppressed in intuitive judgment as well as in perception
- ▶ It is different to see the two versions in close proximity or separately because observers will not spontaneously become aware of the alternative interpretation.
- ▶ Doubt is a phenomenon of System 2, an awareness of one's ability to think incompatible thoughts about the same thing.

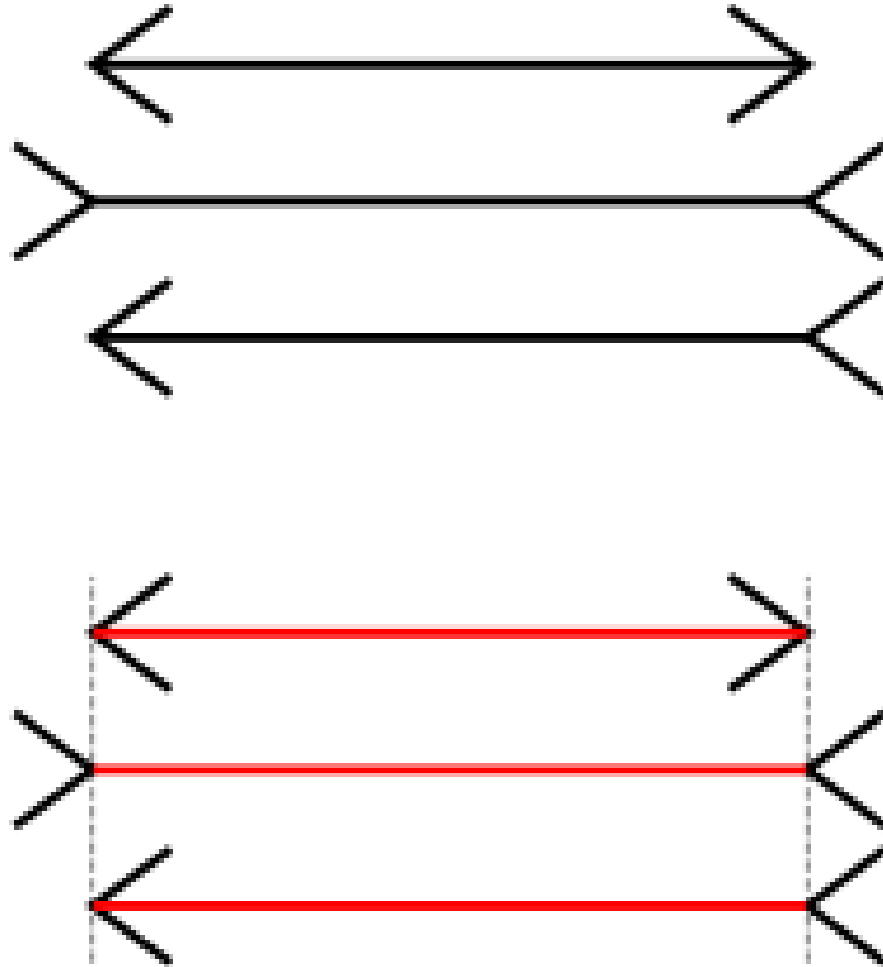
Klein (1998) experienced decision makers working under pressure (e.g., firefighting company captains) rarely need to choose between options because, in most cases, only a single option comes to mind.

# BERNOULLI'S ERROR

- ▶ **Perception is reference-dependent:** the perceived attributes of a focal stimulus redirect the contrast between that stimulus and a context of prior and concurrent stimuli.
- ▶ Immersing the hand in water at 20°C will feel pleasantly warm after prolonged immersion in much colder water, and pleasantly cool after immersion in much warmer water.
- ▶ In contrast, **standard economics** assumes that the utility of decision outcomes is determined entirely by the final state of endowment, and is therefore **reference-independent**.
- ▶ Kahneman defines **Bernoulli's error** the proposition that decision makers evaluate outcomes by the utility of final asset positions which has been retained in economics for almost 300 years.



# MÜLLER-LYER ILLUSIONS



# COGNITIVE AND VISUAL ILLUSIONS

- ▶ System 1 sees that the bottom line is longer than the top line
- ▶ System 2 realizes from measurement in the second slide that the lines are equally long
- ▶ But if you look again at the first slide the bottom line appears longer
- ▶ There is no way to prevent System 1 from generating a wrong impression because it operates automatically and **cannot be turned off at will**
- ▶ Biases cannot be avoided because System 2 have no clue to the error and is too slow and inefficient to serve as a substitute for System 1 in making routine decisions
- ▶ Solution: learn to recognize situations in which mistakes are likely and to monitor them

# ATTENTION AND EFFORT

[http://www.youtube.com/watch?v=IGQmdoK\\_ZfY](http://www.youtube.com/watch?v=IGQmdoK_ZfY)

## ADD-3 TASK

- ▶ To start, make up several strings of 4 digits, all different, and write each string on an index card.
- ▶ Place a blank card on top of the deck.
- ▶ Start beating a steady rhythm.
- ▶ Remove the blank card and read the four digits aloud.
- ▶ Wait for two beats, then report a string in which each of the original digits is incremented by 3.
- ▶ If the digits on the card are 5294, the correct response is 8627.
- ▶ Keeping the rhythm is important.

[http://www.youtube.com/watch?v=qMy\\_6Pgiokk#t=47](http://www.youtube.com/watch?v=qMy_6Pgiokk#t=47)

<http://healthresearchblog.blogspot.it/2011/11/working-memory-with-r-code.html>

# PUPIL SIZE

- ▶ The changing size of your pupils is a faithful record of how hard you worked
- ▶ Pupils' sizes are sensitive indicators of mental effort
- ▶ More the effort is hard more they dilate but with an inverted V
- ▶ Add-1 causes a larger dilation than the task of holding seven digits for immediate recall
- ▶ Add-3 in the first 5 seconds the pupil dilates by about 50% of its original area and heart rate increases by about 7 beats per minute. This is as hard as people can work and they give up. When exposed to more digits their pupils stopped dilating or actually shrank

# SYSTEM 1'S QUICK RESPONSES

- ▶ Pupils offer an index of the current rate at which mental energy is used
- ▶ System 2 have limited capacity and this capacity is allocated second by second to other tasks
- ▶ You cannot allocate attention to others (the invisible gorilla)
- ▶ But orienting and responding quickly to threats or promising opportunities improves the chance of survival
- ▶ System 1 takes over in emergencies and assign total priority to self-protective actions



# SELF-CONTROL

- ▶ System 1 has more influence on behavior when System 2 is busy
- ▶ People who are cognitively busy are also more likely to make selfish choices, use sexist language and make superficial judgments in social situations
- ▶ Add-3 loosens the hold on System 2 on behavior as few drinks or a sleepless night
- ▶ Too much concern about how well one is doing in a task sometimes disrupts performance by loading short-term memory with pointless anxious thoughts (fast and frugal)
- ▶ Self-control requires attention and effort and is a task of System 2 who monitor and control thoughts suggested by System 1

## **Question 1**

*A bat and ball cost \$1.10.*

*The bat costs one dollar more than the ball.*

*How much does the ball cost?*

## **Question 2**

*Is the following argument logically valid?*

*All roses are flowers.*

*Some flowers fade quickly.*

*Therefore some roses fade quickly.*

# BAD INTUITIVE JUDGMENTS

Answer to Q.1 : 10 cents (50-56% among University students - 80% among lay people)

Answer to Q.2 : Yes. Flawed because it is possible that there are no roses among the flowers that fade quickly

Humans are not accustomed to thinking hard and are often content to trust a plausible judgment that quickly comes to mind

The rate of errors in these experiment is good predictor of high discount rate

# THE ORIGIN OF BIASES

System 1 detects simple relations (i.e. “they are all like”) and integrate information about one thing at a time but it does not deal with multiple distinct topics at once

System 2 follow rules, compare objects on several attributes and make deliberate choices between options, adopt “task sets”, i.e. program memory to obey an instruction that overrides habitual responses

But people are overconfident and prone to place too much faith in their intuitions because they find cognitive effort mildly unpleasant and avoid it as much as possible