# A Perspective on Judgment & Choice
Mapping Bounded Rationality

Daniel Kahneman (2003)

***Daniel Kahneman** is a psychologist and economist notable for his work on the psychology of judgment and decision-making, as well as behavioral economics, for which he was awarded the 2002 Nobel Memorial Prize in Economic Sciences. His empirical findings challenge the assumption of human rationality prevailing in modern economic theory.*
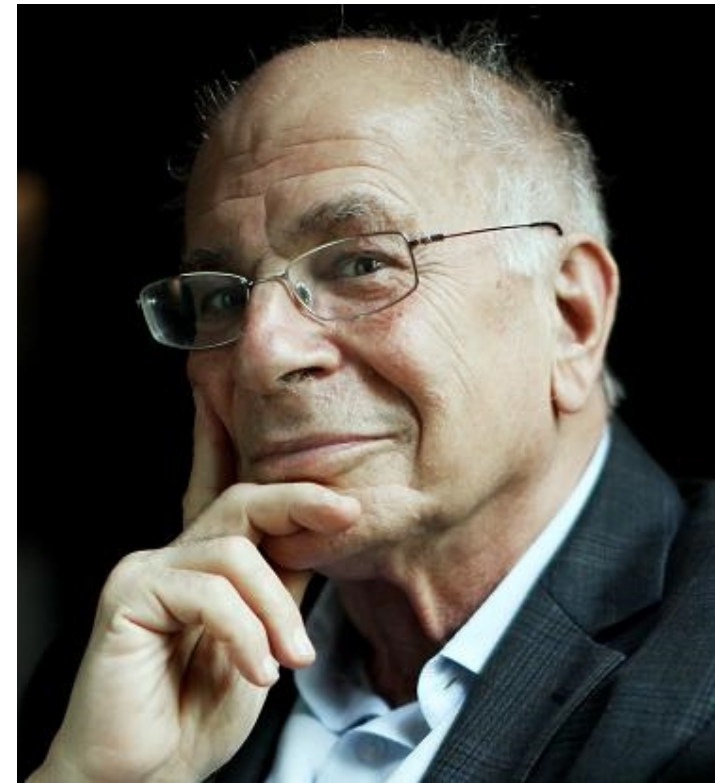
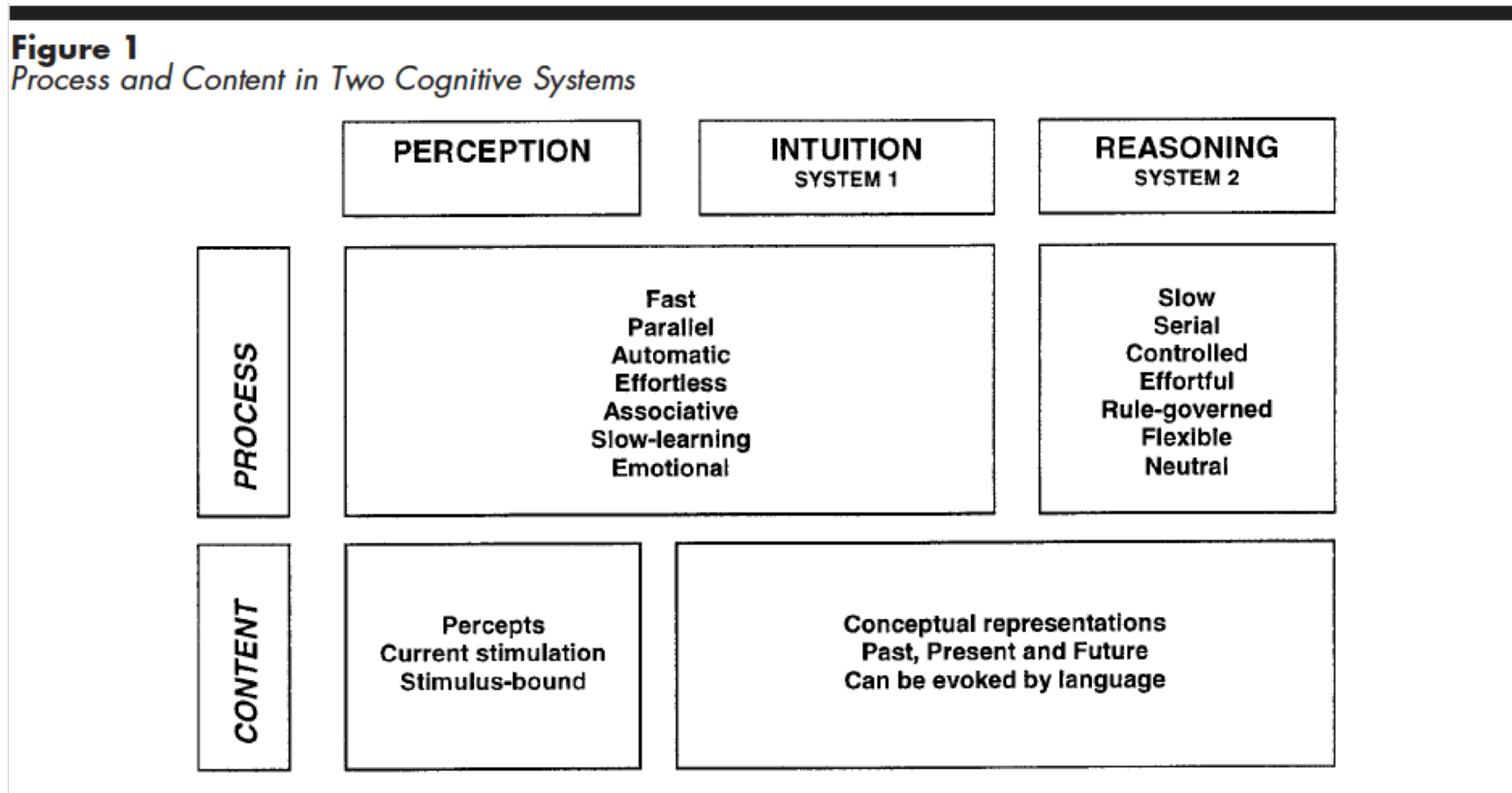# Section 1: Intuition and Accessibility

Figure 1
Process and Content in Two Cognitive Systems
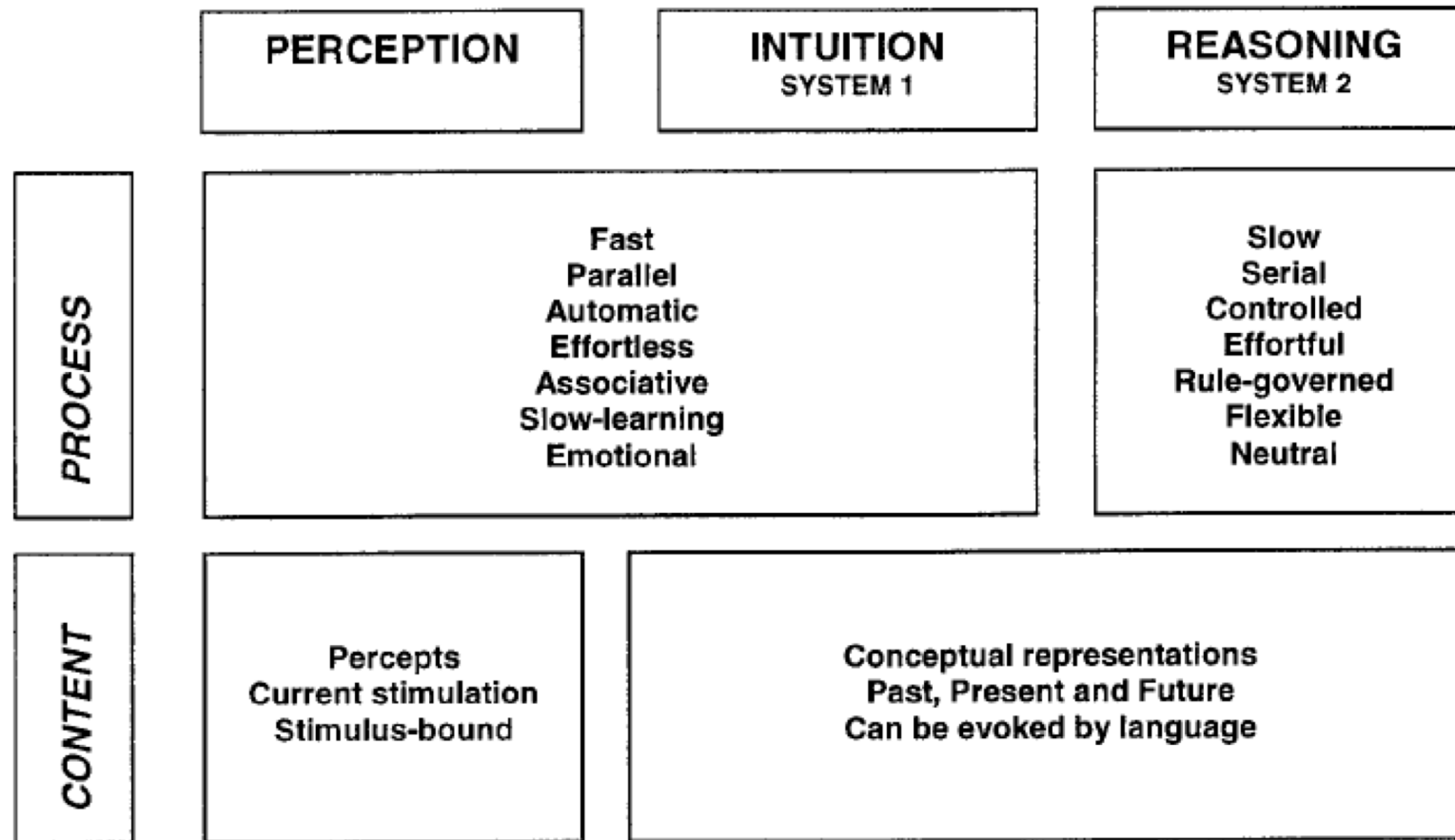
- Observation:

   Complex judgments and preferences are called "intuitive" in everyday language if they come to mind quickly and effortlessly, like percepts.
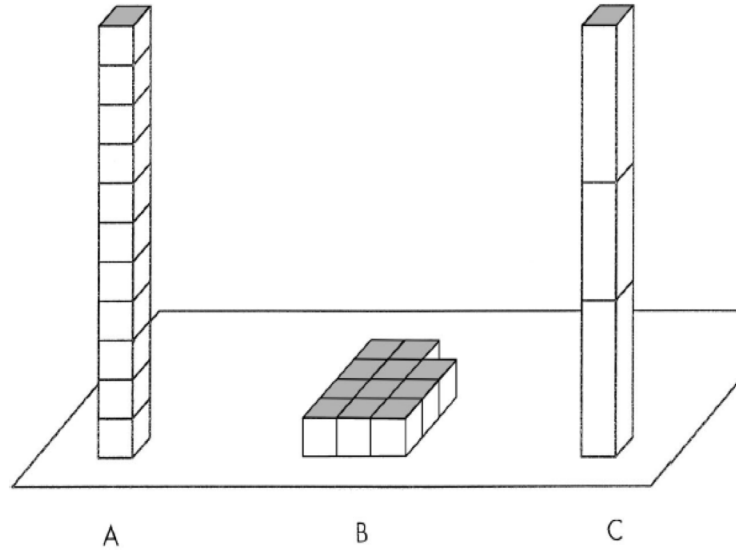
- Proposition: Highly accessible impressions produced by System 1 control judgments and preferences, unless modified or overridden by the deliberate operations of System 2.

Figure 1
Process and Content in Two Cognitive Systems

	PERCEPTION	INTUITION SYSTEM 1	REASONING SYSTEM 2
PROCESS		Fast Parallel Automatic Effortless Associative Slow-learning Emotional	Slow Serial Controlled Effortful Rule-governed Flexible Neutral
CONTENT	Percepts Current stimulation Stimulus-bound	Conceptual representations Past, Present and Future Can be evoked by language	

Selective Accessibility

Figure 2
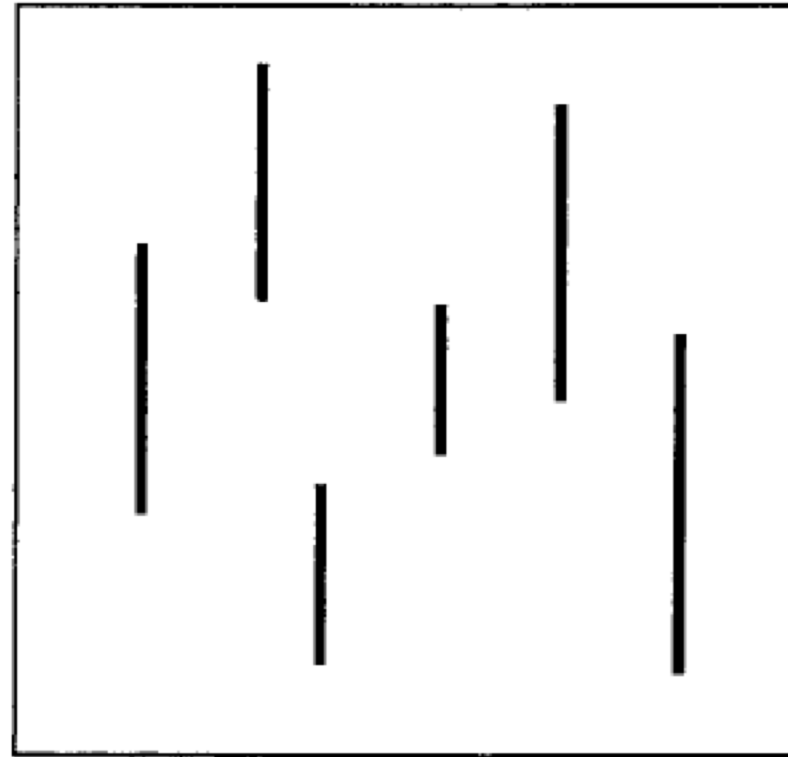*The Selective Accessibility of Natural Assessments*

Selective Accessibility

Which is more accessible?

- Average line length
- Total length of all lines

Figure 3
The Selective Accessibility of Prototypical (Average) Features

What Determines Accessibility?

- Physical salience

What Determines Accessibility?

- New England Patriots beat Los Angeles Rams in the Super Bowl

- Los Angeles Rams lost to New England Patriots in the Super Bowl

Because each sentence draws attention to its subject, however, the two versions make different thoughts accessible.

Natural Assessments

- Tversky and Kahneman (1983):
  Natural Assessments: some objects are routinely and automatically
  registered by the perceptual system or by System 1, without intention or effort.

- Kahneman and Frederick (2002): list of natural assessments
  -physical properties (EX: size, distance, and loudness)
  -more abstract (EX: similarity)
  -causal propensity
  -surprisingness
  -mood
  -…

- Accessibility itself is a natural assessment
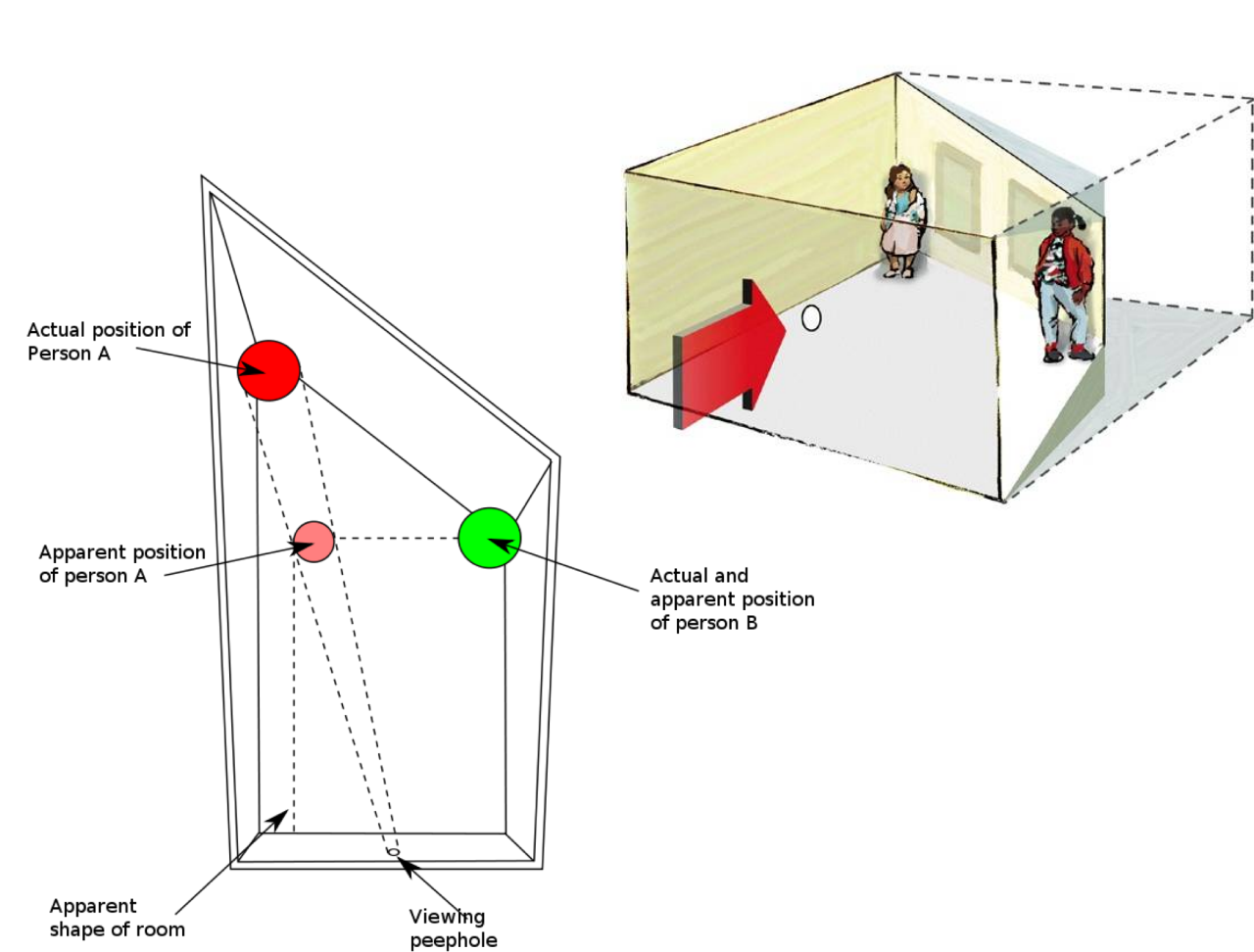
Effect of Context on Accessibility

Figure 4
An Effect of Context on the Accessibility of Interpretations (After Bruner & Minturn, 1955)
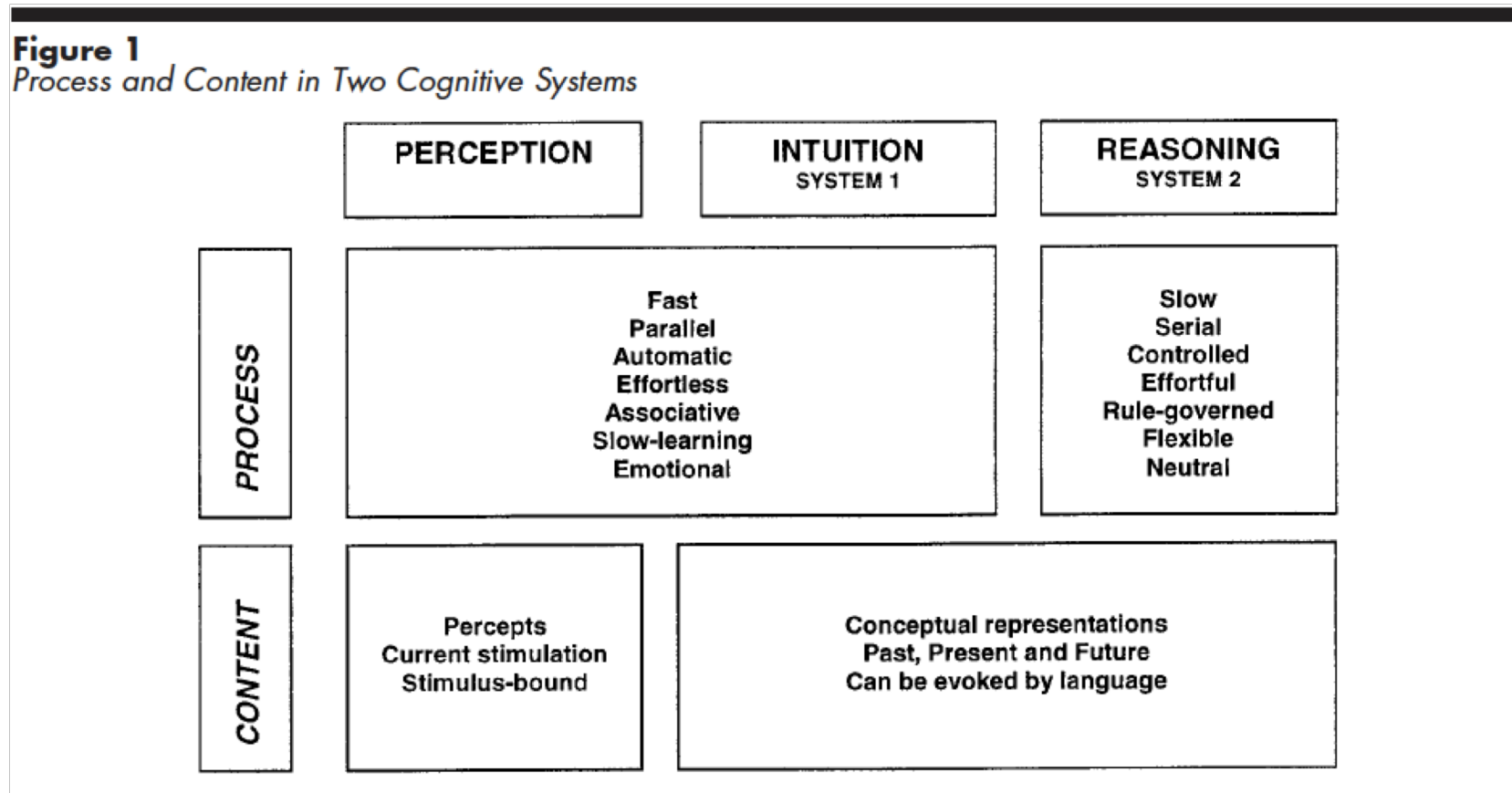
"letter"

"number"

- Ambiguity is suppressed in perception.
- We "see" the interpretation that is the most likely in its context but have no subjective indication that it could be seen differently.

Why does this matter?

- Agenda for research:
  - To understand judgment and choice, we must study the determinants of high accessibility, the conditions under which System 2 overrides or corrects System 1, and the rules of these corrective operations.

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Section 2: Framing Effects

- Alternative formulations of the same situation make different aspects of it accessible.

The Asian Disease Problem – Version 1

Imagine that the United States is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed.

Assume that the exact scientific estimates of the consequences of the programs are as follows:

- Program A: 200 people will be saved.
- Program B: 1/3 probability that 600 people will be saved and a 2/3 probability that no people will be saved.

Which program do you favor?

Result: majority favor Program A, indicating <u>risk aversion</u>.

The Asian Disease Problem – Version 2

Imagine that the United States is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed.

Assume that the exact scientific estimates of the consequences of the programs are as follows:

- Program A: 400 people <mark>will die</mark>.

- Program B: 1/3 probability that nobody will die and a 2/3 probability that 600 people will die.

Which program do you favor?

Result: majority of respondents now favor Program B, the <u>risk-seeking</u> option.

Framing Effects: Version 1 vs. Version 2

- Kahneman & Tversky, 1979: Outcomes that are certain are overweighted relative to outcomes of high or intermediate probability.

- Certainty of saving people is disproportionately attractive, and the certainty of deaths is disproportionately aversive.

- will be saved   vs.   will die

Framing Effects

"Tversky and I restricted the definition of framing effects to discrepancies between choice problems that decision makers, upon reflection, consider _effectively identical_".
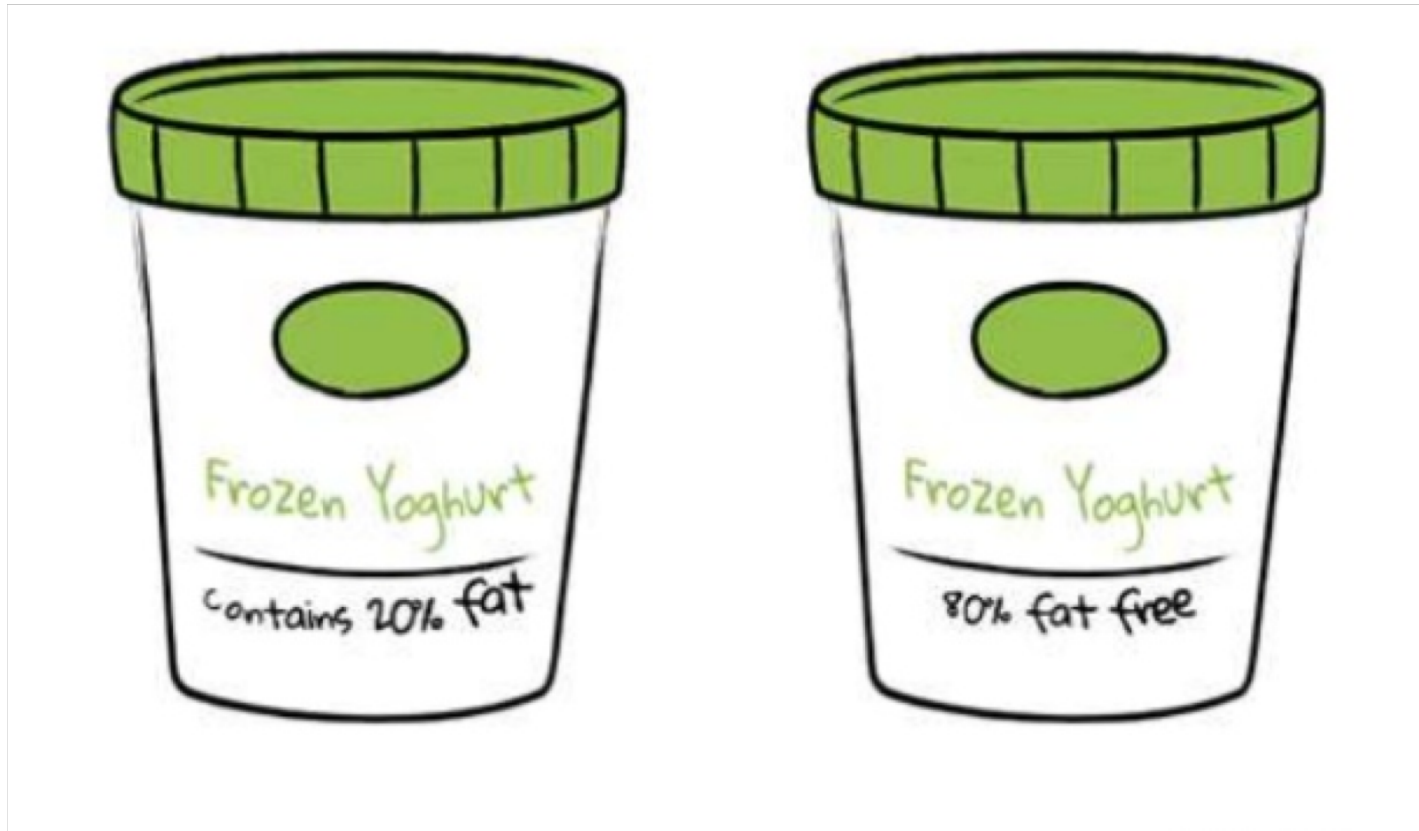
Framing Effects – another example

McNeil, Pauker, Sox, and Tversky (1982):

- Induced different choices between <u>surgery vs. radiation therapy</u> by describing outcome statistics in terms of:

    -<mark>survival rates</mark>

    OR

    -<mark>mortality rates</mark>

- Since 90% short-term survival is less threatening than 10% immediate mortality, the survival frame yielded higher preference for surgery.

- The framing effect as pronounced among experienced physicians as among patients!

Framing: Passive acceptance

Basic principle of framing is the *passive acceptance* of the formulation given.

"It would be possible for a subject to seek that representation which is simplest, according to some criterion, or to translate all such problems into the same, canonical, representation" but that "subjects will not employ such alternative strategies, even though they are available, but will adopt the representation that constitutes the most straightforward translation."
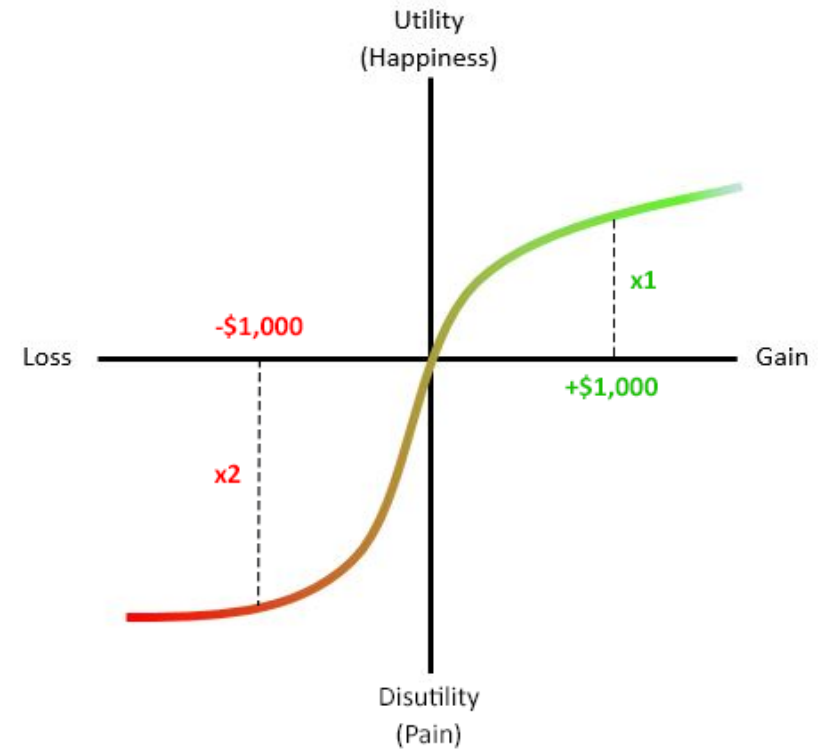
(Simon & Hayes, 1976, p. 183).

Since invariance cannot be achieved by a finite mind...

- **Highly accessible features influence decisions,** whereas features of low accessibility are largely ignored.

- most-accessible features ≠ most-relevant to a good decision.

Recall Prospect Theory…

- Theory that describes the way people choose between probabilistic alternatives that involve risk, where the probabilities of outcomes are uncertain. The theory states that people make decisions based on the potential value of losses and gains rather than the final outcome, and that people evaluate these losses and gains using some heuristics.

# Section 3: Changes or States – Prospect Theory

- Prospect Theory: *changes* and *differences* are more accessible than absolute values.

- Perception is <u>reference dependent</u>: The perceived attributes of a focal stimulus reflect the contrast between that stimulus and a context of prior and concurrent stimuli.

Reference Dependence

Figure 5
Simultaneous Contrast and Reference Dependence
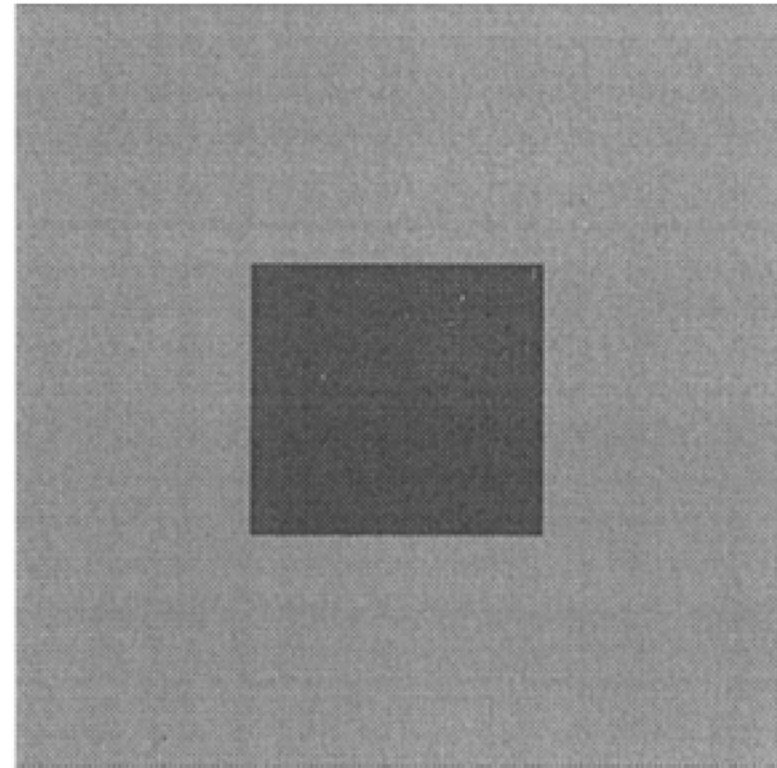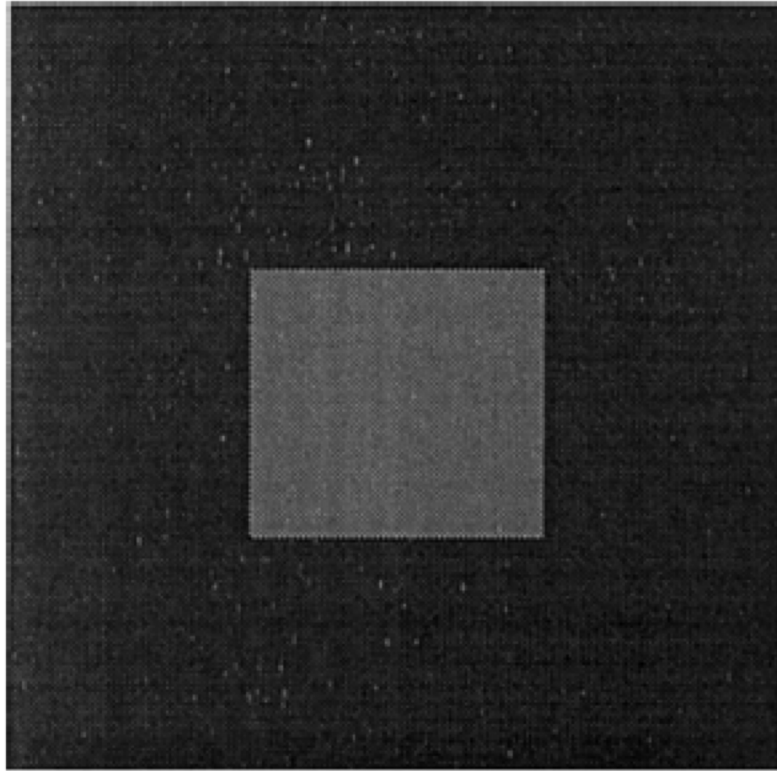
Reference Dependence
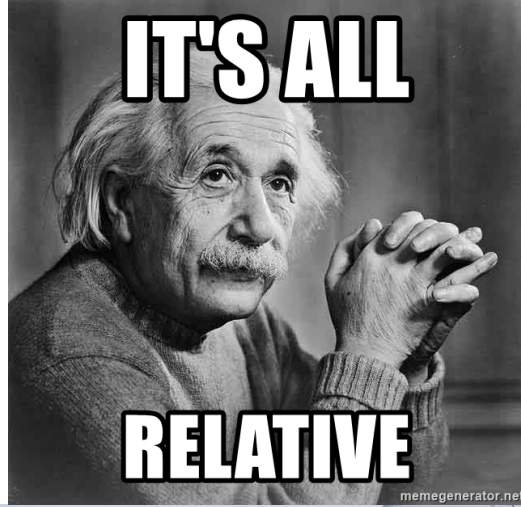
A familiar demonstration involves three buckets of water of different temperatures, arranged from cold on the left to hot on the right, with tepid in the middle. In the adapting phase, the left and right hands are immersed in cold and hot water, respectively. The initially intense sensations of cold and heat gradually wane. When both hands are then immersed in the middle bucket, the experience is heat in the left hand and cold in the right hand.

Bernoulli, 1738/1954:

Value of a gamble is the probability-weighted average of the psychological values (utilities) of its outcomes, which he defined as <u>states of wealth</u>.

Flaw: reference *<u>in</u>*dependent: assumes utility that is assigned to a given state of wealth does *<u>not</u>* vary with the decision maker's initial state of wealth.

Gamble

> **Problem 2**
>
> Would you accept this gamble?
>
>   *50% chance to win $150*
>
>   *50% chance to lose $100*
>
> Would your choice change if your overall wealth were lower by $100?

- Few takers of this gamble

- Most people reject a gamble with even chances to win and lose, unless the possible win is at least twice the size of the possible loss.

- Answer to 2nd question: No.

To Gamble or Not

Problem 3

Which would you choose?

Lose $100 with certainty

or

50% chance to win $50

50% chance to lose $200

Would your choice change if your overall wealth were higher by $100?

- Gamble appears much more attractive than the sure loss. Experimental results indicate that risk-seeking preferences are held by a large majority of respondents in choices of this kind (Kahneman & Tversky, 1979).

- Answer to 2nd question: No.

What's going on?

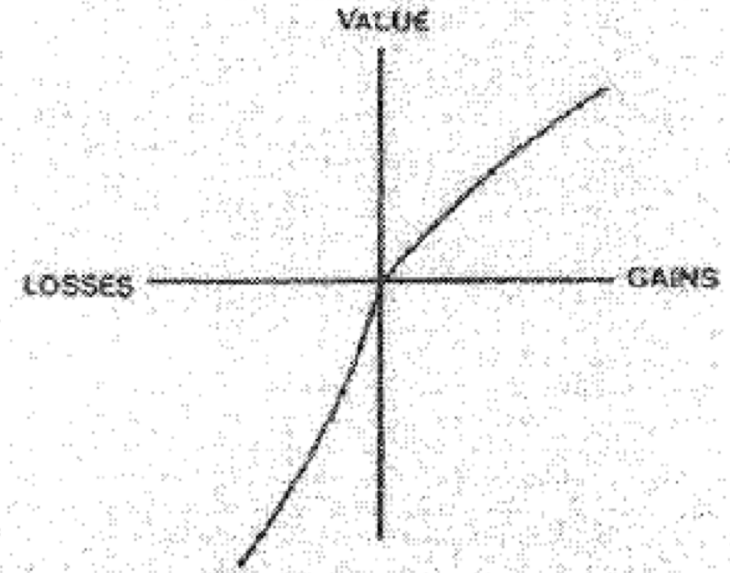- Abrupt transition from risk aversion to risk seeking:
  - could **not** plausibly be explained by a utility function for <u>wealth</u>.

- Preferences appeared to be determined by attitudes to gains and losses, defined *relative to a <mark>reference point</mark>*

- Proposed: alternative theory of risk in which the carriers of utility are gains and losses—<u>changes of wealth</u> rather than states of wealth.

Value Function of Prospect Theory

Figure 6
The Value Function of Prospect Theory

The value function is defined on gains and losses, characterized by four features:

1. Concave in the domain of gains, favor risk aversion
2. Convex in the domain of losses, favor risk seeking

3. Sharply kinked at the reference point and loss averse—steeper for losses than for gains by a factor of about 2–2.5 (Kahneman, Knetsch, & Thaler, 1991; Tversky & Kahneman, 1992)

4. The functions in the two domains ~ power functions with similar exponents (Swalm, 1966; Tversky & Kahneman,1992).

Significance: Value Function of Prospect Theory

Bernoulli:

Kahneman:

Utility function = wealth

Utility function = changes of wealth

Thaler (1980):

A good is worth more when it is considered as something that could
be lost or given up than when it is evaluated as a potential gain.

Narrow Framing

> **Problem 5**
>
> Two persons get their monthly report from a broker:
>
> A is told that her wealth went from 4M to 3M.
>
> B is told that her wealth went from 1M to 1.1M.
>
> (i) Who of the two individuals has more reason to be satisfied with her financial situation?
>
> (ii) Who is happier today?

- Bernoulli: only long-term consequences matter.
- Prospect Theory: short-term outcomes. Value function ~ intensity of emotions experienced at moments of transition from one state to another (Kahneman, 2000b, 2000c; Mellers, 2000).
- Which utility is more useful?
  - Descriptive purposes: myopic
  - Rational agent model: Bernoulli

The Case for Narrow Frames

"It is worth noting that an exclusive concern with the broad view and with the long term may be prescriptively sterile because the long term is not where life is lived. Utility cannot be divorced from emotion, and emotion is triggered by changes. A theory of choice that completely ignores feelings such as the pain of losses and the regret of mistakes is not just descriptively unrealistic. It also leads to prescriptions that do not maximize the utility of outcomes as they are actually experienced".

Section 4:
Attribute Substitution – A Model of Judgment by Heuristic

- An <u>attribute substitution</u> model of heuristic judgment.

"People rely on a limited number of heuristic principles which reduce the complex tasks of assessing probabilities and predicting values to simpler judgmental operations.
In general, these heuristics are quite useful, but sometimes they lead to severe and systematic errors".
(Tversky & Kahneman, 1974, p. 1124)

This illusion works because 3D (perspective) size is substituted for 2D size (all pairs are equal in size)

Heuristic process: Attribute Substitution

- The individual assesses a specified target attribute of a judgment object by substituting a related heuristic attribute that comes more readily to mind.

- EX: people who are confronted with a difficult question sometimes answer a related easier one instead.

- The definition of judgment heuristics by attribute substitution applies to many situations where people make a judgment that is not the one they intended to make.

Attribute Substitution in Perception

Figure 7
Attribute Substitution in Perception: A Highly Accessible Heuristic Attribute (Three-Dimensional Size) Substitutes for a Less Accessible Target Attribute (Picture Size)

- The cognitive illusions that are produced by attribute substitution: An impression of one attribute is mapped onto the scale of another, and the judge is normally unaware of the substitution.

The Linda Problem

- "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 antinuclear demonstrations".

- Study: Respondents were shown the description of a woman named Linda and a list of Linda's employment and activities, including:
  - "Linda is a bank teller"
  - "Linda is a bank teller and active in the feminist movement"

- Some respondents had to rank options by <u>similarity</u> of Linda to the category prototypes; others ranked by <u>probability</u>.

The Linda Problem – Conjunction Fallacy

- <u>Similarity results: </u>85% of respondents indicated Linda resembles the image of a feminist bank teller more than she resembles a stereotypical bank teller.

- <u>Probability results: </u>89% of respondents indicated it's more probable that Linda is a feminist bank teller than a bank teller.   ← <u>Conjunction Fallacy!</u>

CAN SWIM

HAVE FINS

whales

shrimp

fish

jellyfish

sharks

sea turtles
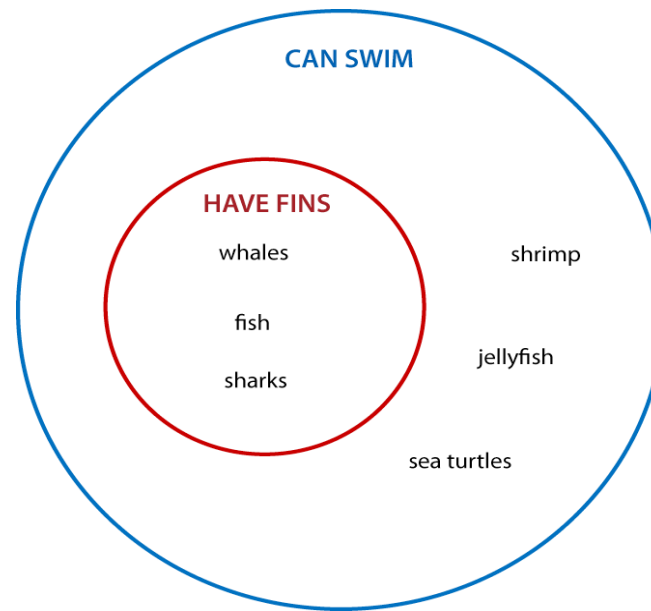
Attribute substitution, what gives?

- Respondents offer a reasonable answer to a question that they have not been asked.

- Respondents' judgments reflect their understanding of the question that was posed
    - (EX: sports betting as relative strength of the competing teams).

- More plausible: evaluation of the heuristic attribute comes immediately to mind and that its associative relationship with the target attribute is sufficiently close to pass the permissive monitoring of System 2. Respondents who substitute one attribute for another are not confused about the question that they are trying to answer—they simply fail to notice that they are answering a different one.

College Student Survey:

(Strack et al., 1988)

1). "How happy are you with your life in general?"

2). "How many dates did you have last month?"

_____

No correlation in responses

College Student Survey:

(Strack et al., 1988)

1). "How many dates did you have last month?"

2). "How happy are you with your life in general?"

_____
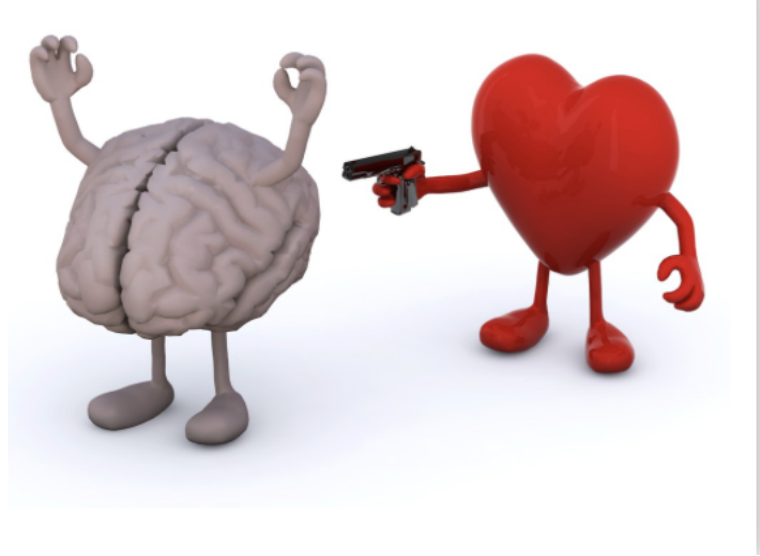
    .66 correlation in responses

What happened?

- Attribute substitution:

  Dating question automatically evokes an affectively charged evaluation of one's satisfaction in that domain of life, which lingers to become the heuristic attribute when the happiness question is subsequently encountered.

Affect Heuristic

- Slovic et al., 2002: Definition = heuristic in which current emotion influences decisions.

- Bargh, 1997; Zajonc, 1980, 1998: Every stimulus evokes an affective evaluation, not always conscious. Their treatment of the affect heuristic fits the present model of attribute substitution.

- Kahneman and Ritov (1994) and Kahneman et al. (1999): an automatic affective valuation—emotional core of an attitude—is main determinant of many judgments and behaviors.

Accessibility of Corrective Thought

- When people become aware of using a heuristic, they correct their judgment accordingly and may even overcorrect.

- EX: How System 2 might have intervened in the Linda Problem:

"Linda cannot be more likely to be a feminist bank teller than to be a bank teller. I must rank these two outcomes accordingly".

Section 5: Prototype Heuristics

- A family of prototype heuristics, which share a common mechanism and a remarkably consistent pattern of cognitive illusions, analogous to the effects observed in the Linda Problem (Kahneman & Frederick, 2002).

- Roughly, the substitution of an average for a sum (Anderson, 1981, pp. 58–70, 1991a, 1991b, 1996).

- Illustrates conditions under which System 2 prevents or reduces judgment biases.
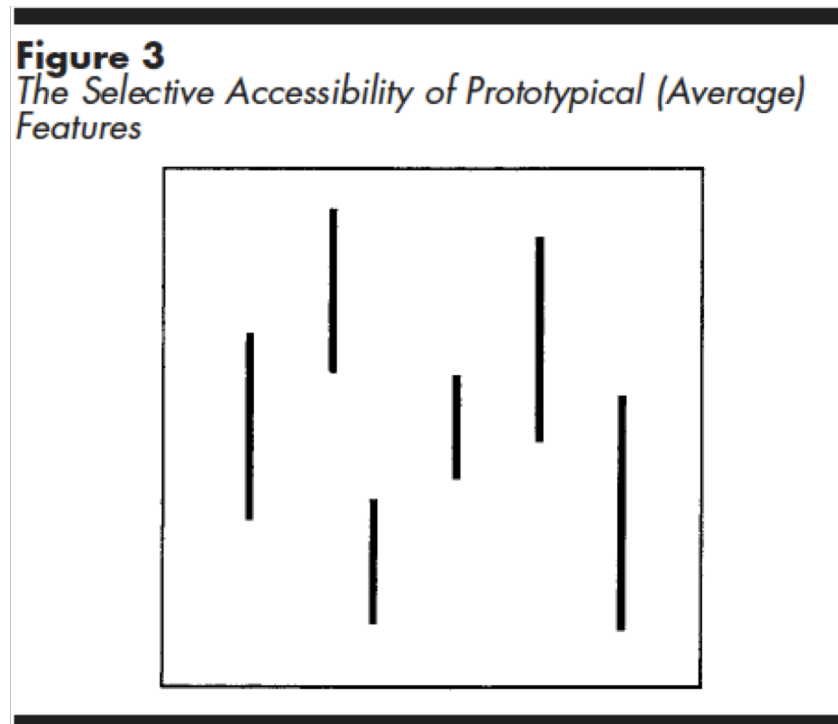
Extensional Attributes and Extensions

Task	Extensional Attribute	Extension
Category prediction	P(set of bank tellers contains Linda)	number of bank tellers
Pricing a quantity of goods	$ value of saving a certain number of birds from drowning in oil ponds	number of birds
Global evaluation of a past experience over time	Overall aversiveness of open heart surgery	surgery duration

- The value of an <u>extensional attribute</u> in a set is an aggregate (not necessarily additive) of the values over its <u>extension</u>.

Extensional Attributes

- Low in accessibility–thus, candidate for heuristic judgment.

- Logic: principle of conditional adding

(AKA each element of the set adds to the overall value an amount that depends on the elements already included)

Figure 3
The Selective Accessibility of Prototypical (Average) Features

Extensional attribute:

total length of the set of lines

Notice: **<u>NOT</u>** very accessible!

Prototype Attributes

- Highly accessible!

- A category or set that is sufficiently homogeneous can be described by its <u>prototype attributes</u>.

- Whenever people look at, or think about, an ensemble or category that has a prototype, information about the prototype becomes accessible.

Figure 3
The Selective Accessibility of Prototypical (Average) Features
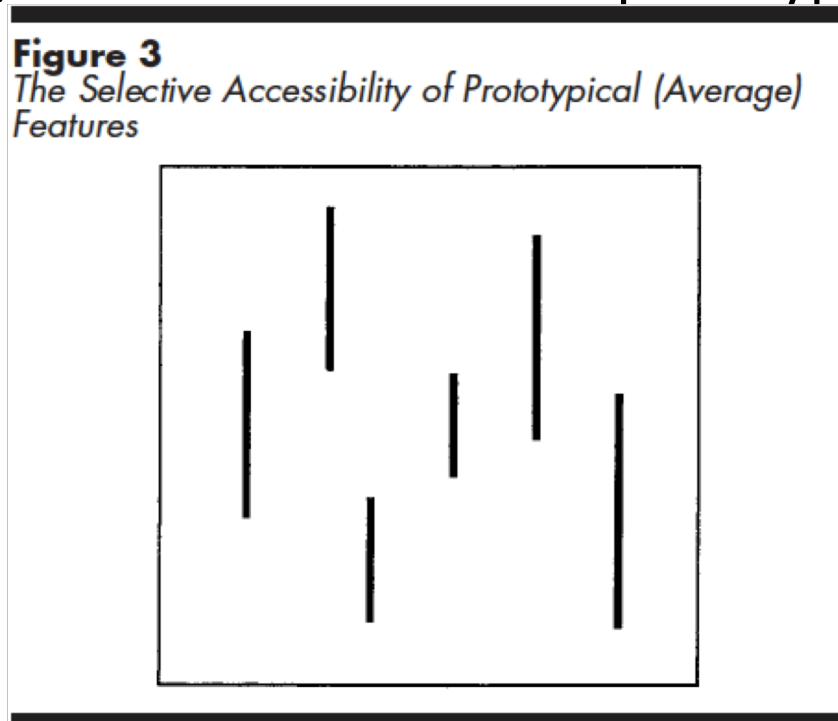
Prototype attribute:

average length of a line

Prototype Heuristic

- Substituting an attribute of a prototype for an extensional attribute of its category.

- EX: use of representativeness in category prediction

  P(Linda being a bank teller) = extensional attribute

  Linda's resemblance to a typical bank teller = prototype attribute

Prototype Heuristics – tests needed!!

- Because extensional and prototypical attributes are governed by different logical rules, the substitution of a prototype attribute for an extensional attribute entails two testable biases:

    - extension neglect
    - violations of monotonicity

Test: Extension Neglect

- Idea: doubling the frequencies of all values in a set does not affect prototype attributes because measures of central tendency depend only on relative frequencies. In contrast, the value of an extensional attribute increases monotonically with extension.

- Hypothesis: judgments of a target attribute are mediated by a prototype heuristic gains support if the judgments are insensitive to variations of extension.

- Reject hypothesis if small proportion of participants show some sensitivity to extension.

Test: Extension Neglect

- Difficult to pass test ☹ Most people will respond to extension.

- EX: willingness to pay (WTP) for saving birds should increase with the number of birds saved.

- EX: extending a painful medical procedure by an extra period of pain makes it worse.

Test: Extension Neglect

- However… Some favorable situations where extension is neglected ☺

Test: Extension Neglect

- Desvousges et al. (1993): Study participants indicated their willingness to contribute money to prevent the drowning of migratory birds. The number of birds that would be saved was varied for different subsamples.

- Results:

Households willing to pay	To save ___ birds
$80	2,000
$78	20,000
$88	200,000

Extension Neglect!
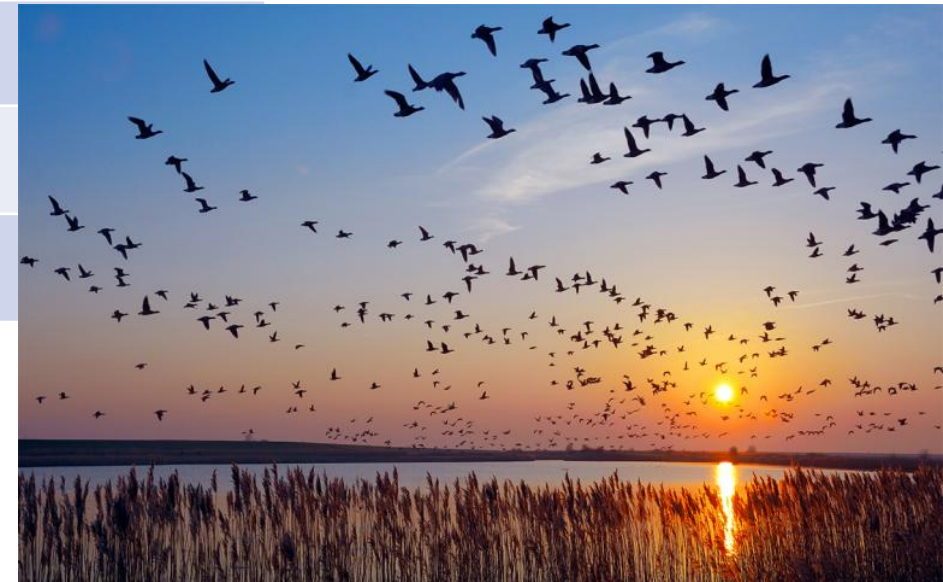
Test: Extension Neglect

- Kahneman and Knetsch: WTP for public goods

- Study: survey respondents on how much they're willing to pay to clean up various-sized regions of lakes

- Results: Toronto survey respondents were willing to pay similar amounts to clean up the lakes in a small region of Ontario or to clean up all the lakes in that province (reported by Kahneman, 1986).
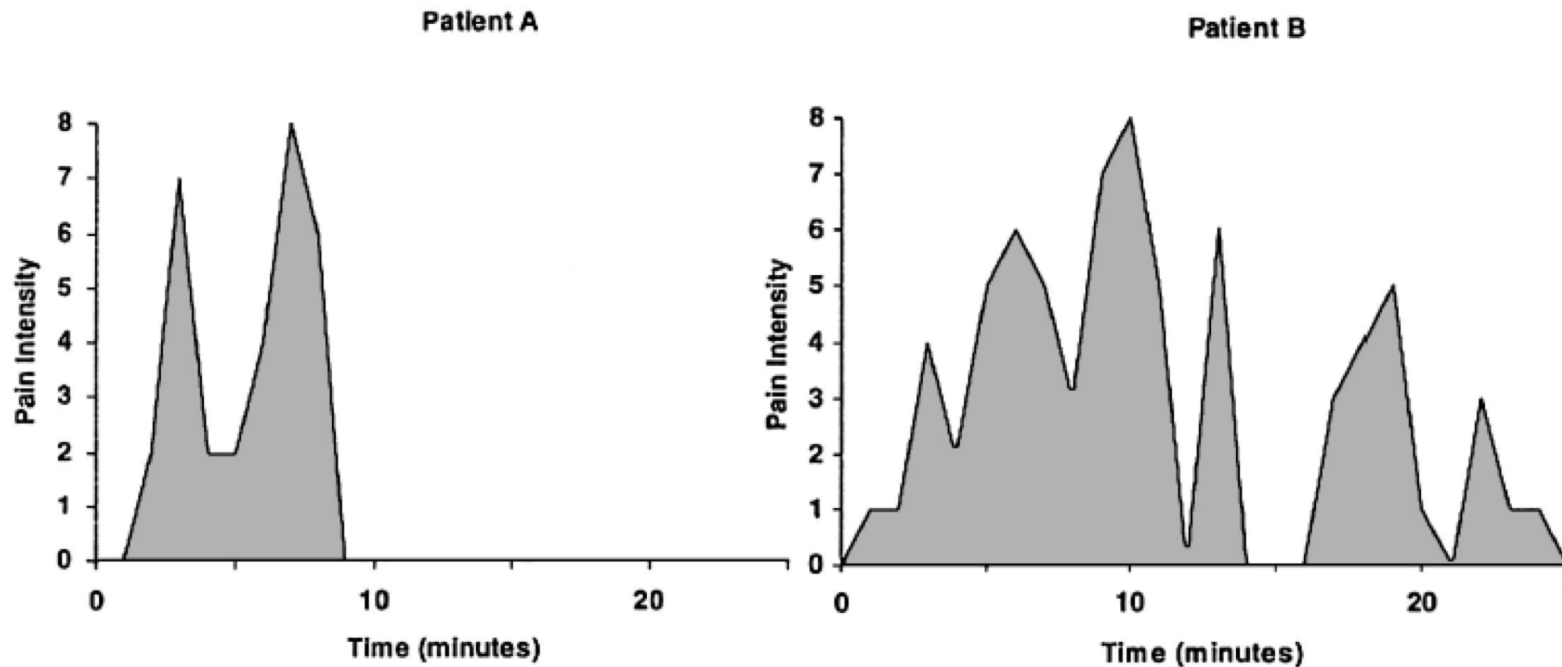
Extension Neglect!
(scope neglect)

Test: Extension Neglect

- Redelmeier and Kahneman (1996): patients undergoing colonoscopy reported the intensity of pain every 60 seconds during the procedure and subsequently provided a global evaluation of the pain they had suffered.

- Who had a more negative evaluation of the colonoscopy procedure?


Figure 9
Pain Intensity Reported by Two Colonoscopy Patients

Test: Extension Neglect

- Correlation of global evaluations with procedure duration: 0.03
- Correlation of global evaluation with an average of the pain reported at 2 points of the procedure: *when pain was at its peak & *just before the procedure ended: 0.67
- Patient A reported a more negative evaluation of the procedure than Patient B.

Figure 9
Pain Intensity Reported by Two Colonoscopy Patients
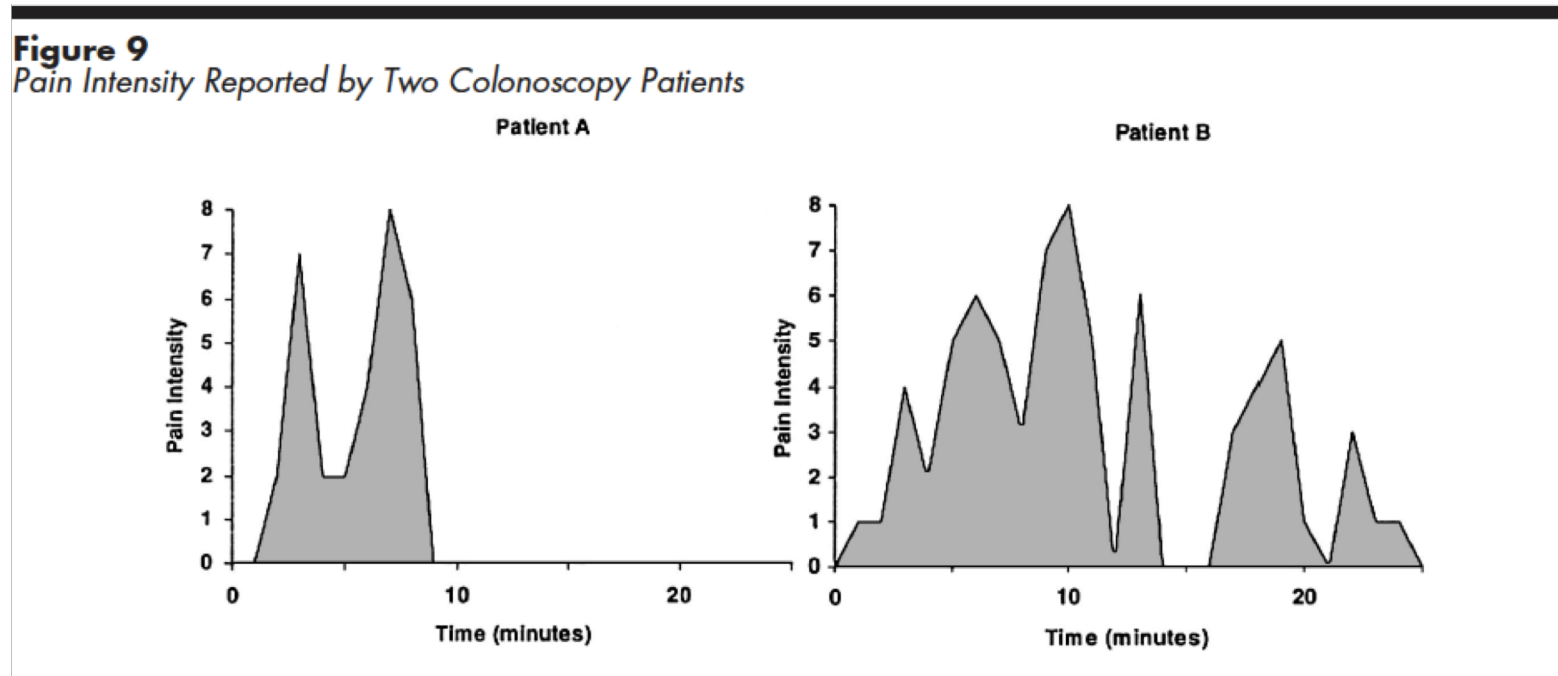
Extension Neglect!
(duration neglect)

Test: Extension Neglect

- Situations where people do NOT neglect extension completely.
  Extension effects are expected if the individual:

  A). has information about the extension of the relevant set,

  B). is reminded of the relevance of extension, &

  C). is able to detect their intuitive judgment neglects extension.

Test: Extension Neglect

- Complete extension neglect likely—when:

    - judge evaluates a single object, and

    - extension of set is not explicitly mentioned.

Test: Monotonicity

- Idea: extensional variables, like sums, obey monotonicity. The sum of a set of positive values is at least as high as the maximum of its subsets. In contrast, the average of a subset can be higher than the average of a set that includes it. <u>Violations of monotonicity are therefore bound to occur when an extensional attribute is judged by a prototype attribute.</u>

- It is always possible to find cases in which adding elements to a set causes the judgment of the target variable to decrease.

- Systematic violation of monotonicity in judgment and choice = strongest support for hypothesis that prototype attributes are being substituted for extensional attributes.

Test: Monotonicity

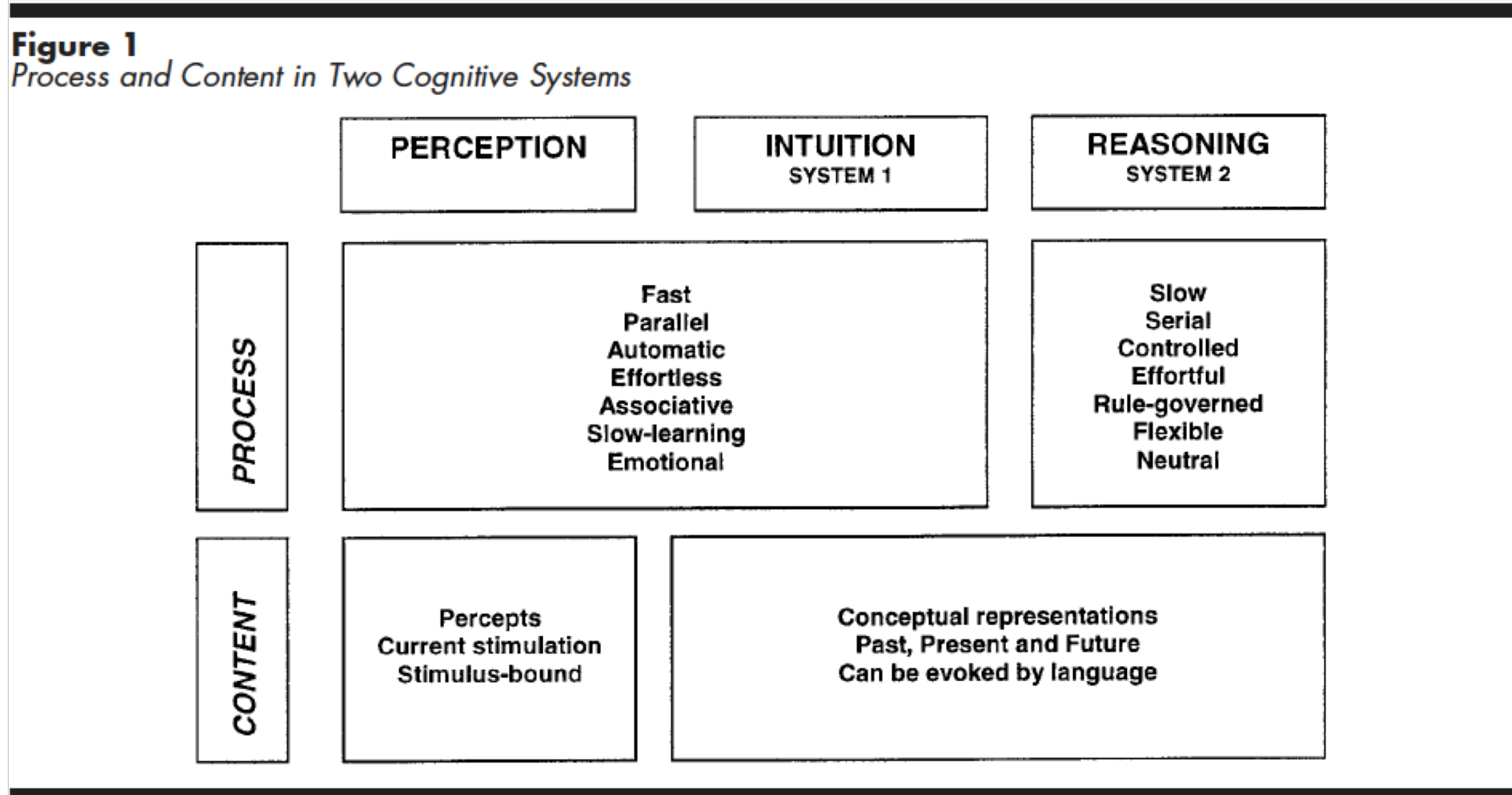Kahneman, Fredrickson, Schreiber, and Redelmeier (1993):

- Participants submerged hands in cold water:
  - one hand in 14 °C water for 60 seconds,
  - other hand in 14 °C water for 60 seconds + additional 30 seconds where water gradually warmed to 15 °C.

- Participants asked which of the two experiences they preferred to repeat.

- Result: Most chose the long trial. "Peak-End Rule"

- Basic result replicated with unpleasant sounds of variable loudness and duration (Schreiber & Kahneman, 2000).

Test: Monotonicity

- Although the participants were exposed to both experiences (joint evaluation), they did not notice that the long episode contained all the pain of the short one and then some extra pain. Most respondents would have made a different choice if they had understood the structure of the options.

- The substitution of prototype attributes for extensional attributes appears to be a general characteristic of System 1

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2 distinct ways of choosing

- *Choosing By Liking* (Kahneman, 1994):
  - Non-analytical

  - Consider the global evaluation of the two options separately and select the option that has the higher global value, without detailed comparison of alternatives.

- Choice by Dominance:
  - If detect one option dominates the other, choose the dominant option without consulting their separate valuations.