

## PHIL 5983: Rationality Seminar

University of Arkansas, Fall 2004

**Topic:** Apparent, Systematic Shortcomings in Human Reasoning

**Readings:** Tversky and Kahneman's "Judgment under Uncertainty: Heuristics and Biases", "Availability: A Heuristic for Judging Frequency and Probability", and "Extensional Versus Intuitive Reasoning: The Conjunction Fallacy in Probability Judgment"

Judgmental heuristic: A cognitive shortcut, or rule of thumb, that is used, either consciously or not, to reach a judgment. A heuristic process is contrasted with an algorithmic process (the latter guarantees success if employed correctly).

Cognitive bias: An unmotivated (e.g., not caused by wishful thinking, loyalty, or any other kind of vested interest) error of judgment. The use of judgmental heuristics can result in systematic cognitive biases.

Cognitive illusion: The cognitive analogue of a visual illusion. Like visual illusions, cognitive illusions are situations in which subjects naturally (or commonly) "see" (or judge) things contrary to how they in fact are (or perhaps even could be). Even when a visual illusion is pointed out, we typically continue to visually see the scene in the misleading manner. Similarly, even when a cognitive illusion is pointed out, we typically continue to cognitively "see" the problem in a misleading manner.

Framing effect: When different presentations of what is, formally, the same problem yield different judgments or modes of evaluation.

### **"Judgment under Uncertainty: Heuristics and Biases"**

Q: How do we assess the probability or quantitative value of an uncertain outcome or quality?

T&K propose 3 judgmental heuristics to account for the experimental evidence. These judgmental heuristics explain the observed cognitive biases.

1. Representativeness: "...probabilities are evaluated by the degree to which A is representative of B, that is, by the degree to which A resembles B." (1124)

This heuristic leads to the following biases:

- a) Insensitivity to prior probability of outcomes (i.e., base-rate neglect)

--Lawyer/engineer example

b) Insensitivity to sample size (i.e., ignorance of the law of large numbers)

Law of Large Numbers: Larger sample sizes tend to be more representative of the general population. Greater fluctuations from the general population's mean are to be expected in smaller sample sizes. (This is a rough characterization only.)

--Hospital/child-birth example

c) Misconceptions of chance (e.g., Gambler's Fallacy)

Gambler's Fallacy: The erroneous belief that when a random process generates a string of outcomes of a given kind, outcomes of another kind thereby become more likely than they would have been without the preceding run.

--Coin flip examples

d) Insensitivity to predictability

e) The illusion of validity

f) Misconceptions of regression (e.g., ignorance of regression to the mean)

Regression to the Mean: To the extent that outcomes are random, extraordinary outcomes are likely to be followed by more average ones.

--Failure to recognize this phenomenon can lead one to over-estimate the utility of punishment, and under-estimate the utility of reward.

## 2. Availability

a) Biases due to the retrievability of instances

--E.g., how recent or salient an instance was skews retrievals.

b) Biases due to the effectiveness of a search set

c) Biases of imaginability

d) Illusory correlation

## 3. Adjustment and Anchoring

a) Insufficient adjustment

--African nations example

- b) Biases in the evaluation of conjunctive and disjunctive events
- c) Anchoring in the assessment of subjective probability distributions

\*One theme that T&K stress is that these systematic errors occur in both laypeople and experts.

\*\*\*I am not posting any notes for “Availability: A Heuristic for Judging Frequency and Probability”

### **“Extensional Versus Intuitive Reasoning: The Conjunction Fallacy in Probability Judgment”**

Conjunction fallacy: Judging a conjunction to be more probable than one of its conjuncts.

Extension Rule: “If the extension of A includes the extension of B (i.e.,  $A \supset B$ ) then  $P(A) \geq P(B)$ .” (294)

“In contrast to formal theories of belief, intuitive judgments of probability are generally not extensional.” (294)

\*“The student of judgment uses the probability calculus as a standard of comparison much as a student of perception might compare the perceived sizes of objects to their physical sizes. Unlike the correct size of objects, however, the “correct” probability of events is not easily defined. Because individuals who have different knowledge or who hold different beliefs must be allowed to assign different probabilities to the same event, no single value can be correct for all people. Furthermore, a correct probability cannot always be determined even for a single person.” (293)

\*We tend to categorize things according to models (e.g., prototypes and schemata), and we should expect this to influence our probability judgments. This influence is found in the representativeness heuristic:

“Representativeness is an assessment of the degree of correspondence between a sample and a population, an instance and a category, an act and an actor or, more generally, between an outcome and a model.” (295)

--Representativeness is often a good heuristic, because representativeness generally correlates with frequency.

However, 3 ways in which representativeness goes wrong:

1. A very specific outcome can be representative but unlikely.
2. An outcome or attribute can be highly diagnostic, but still unlikely.
3. An individual can be representative of a broader category, without being representative of the sub-category to which it belongs (i.e., chicken as representative of animals, but not birds). (296)

--The "Linda and Bill" experiment.

\*Indirect, direct-subtle, and direct-transparent tests.

\*The experimental results when the Linda example is presented in argument form is particularly surprising (and disappointing). Also note the error rate for trained graduate students! (299-300)

\*Further tests: medical judgment, predicting Wimbledon, and risky choice.

--Note the various alternative explanations of the data that they consider, in addition to the charge of irrationality. E.g. "Is it possible that the subjects interpreted the target events in a nonextensional manner that could justify or explain the observed ranking? ... Another possible interpretation of the conjunction error maintains that instead of assessing the probability  $P(B/E)$  of Hypothesis B (e.g., that Linda is a bank teller) in light of evidence E (Linda's personality), subjects assess the inverse probability  $P(E/B)$  .... If the conjunction fallacy cannot be justified by a reinterpretation of the target events, can it be rationalized by a nonstandard conception of probability? ... as a misunderstanding of the word *probability*." (302-303)

\*T&K's standard for these errors to count as *fallacies*:

"A judgment is appropriately labeled a fallacy when most of the people who make it are disposed, after suitable explanation, to accept the following propositions: (a) They made a non-trivial error, which they would probably have repeated in similar problems, (b) the error was conceptual, not merely verbal or technical, and (c) they *should* have known the correct answer or a procedure to find it." (304)

--Errors that aren't fallacies are *misunderstandings*.

--"A psychological analysis should apply interpretive charity and should avoid treating genuine misunderstandings as if they were fallacies." (304)

\*Notice the tendency toward the conjunction fallacy when the conjuncts have a causal or otherwise explanatory connection. (305-308)

“The attorney who fills in guesses regarding unknown facts, such as motive or mode of operation, may strengthen a case by improving its coherence, although such additions can only lower probability.” (308)

\*Their conclusion about the implications of this research for human rationality:

“The focus on bias and illusion is a research strategy that exploits human error, although it neither assumes nor entails that people are perceptually or cognitively inept....In cognition, as in perception, the same mechanisms produce both valid and invalid judgments. Indeed, the evidence does not seem to support a ‘truth plus error’ model, which assumes a coherent system of beliefs that is perturbed by various sources of distortion and error. Hence, we do not share Dennis Lindley’s optimistic opinion that “inside every incoherent person there is a coherent one trying to get out,” and we suspect that incoherence is more than skin deep.” (313)

“In the absence of an objective criterion of validity, the normative theory of judgment under uncertainty has treated the coherence of belief as the touchstone of human rationality. Coherence has also been assumed in many descriptive analyses in psychology, economics, and other social sciences. This assumption is attractive because the strong normative appeal of the laws of probability makes violations appear implausible. Our studies of the conjunction rule show that normatively inspired theories that assume coherence are descriptively inadequate, whereas psychological analyses that ignore the appeal of normative rules are, at best, incomplete. A comprehensive account of human judgment must reflect the tension between compelling logical rules and seductive nonextensional intuitions.” (313-314)