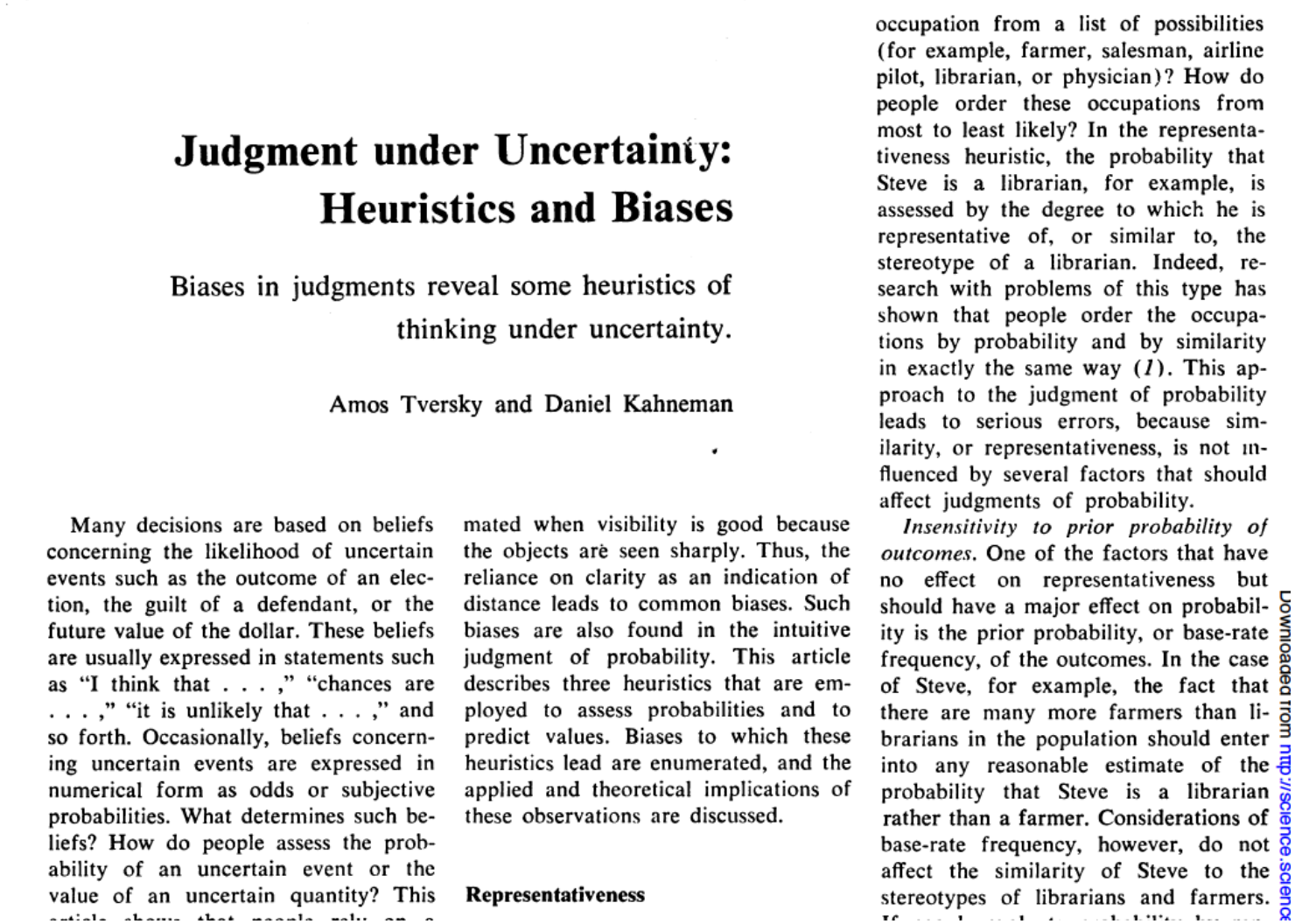
Heuristics and biases

EE416 Semester 2/2019

Tversky and Kahneman (1974)



Judgment under Uncertainty: Heuristics and Biases

Biases in judgments reveal some heuristics of thinking under uncertainty.

Amos Tversky and Daniel Kahneman

Many decisions are based on beliefs concerning the likelihood of uncertain events such as the outcome of an election, the guilt of a defendant, or the future value of the dollar. These beliefs are usually expressed in statements such as "I think that . . . ," "chances are . . . ," "it is unlikely that . . . ," and so forth. Occasionally, beliefs concerning uncertain events are expressed in numerical form as odds or subjective probabilities. What determines such beliefs? How do people assess the probability of an uncertain event or the value of an uncertain quantity? This

mated when visibility is good because the objects are seen sharply. Thus, the reliance on clarity as an indication of distance leads to common biases. Such biases are also found in the intuitive judgment of probability. This article describes three heuristics that are employed to assess probabilities and to predict values. Biases to which these heuristics lead are enumerated, and the applied and theoretical implications of these observations are discussed.

Representativeness

occupation from a list of possibilities (for example, farmer, salesman, airline pilot, librarian, or physician)? How do people order these occupations from most to least likely? In the representativeness heuristic, the probability that Steve is a librarian, for example, is assessed by the degree to which he is representative of, or similar to, the stereotype of a librarian. Indeed, research with problems of this type has shown that people order the occupations by probability and by similarity in exactly the same way (*1*). This approach to the judgment of probability leads to serious errors, because similarity, or representativeness, is not influenced by several factors that should affect judgments of probability.

Insensitivity to prior probability of outcomes. One of the factors that have no effect on representativeness but should have a major effect on probability is the prior probability, or base-rate frequency, of the outcomes. In the case of Steve, for example, the fact that there are many more farmers than librarians in the population should enter into any reasonable estimate of the probability that Steve is a librarian rather than a farmer. Considerations of base-rate frequency, however, do not affect the similarity of Steve to the stereotypes of librarians and farmers.

- Heuristics and biases is where Kahneman and Tversky's research collaboration began.

Introduction

- Unlike the other original major topics in Behavioral Economics, risk preferences, time preferences, and social preferences, heuristics and biases is primarily about beliefs.

- So far, the main impact in economics has been on behavioral finance:
  - Overconfidence
  - Biases in inference

- This area is ripe for formulating new models and finding field evidence.

Introduction

- In 1968-1969, in Daniel Kahneman's grad class, Amos Tversky gave a guest lecture about judgment and decision-making.

- Kahneman and Tversky began to collaborate on a research program to identify **the psychological processes, the presumably-simple heuristics that actually generated judgments**.

- The research program has two steps:

    1. **Biases:** Identify systematic biases relative to the normative model.
    2. **Heuristics**: Hypothesize (and test) a heuristic that can explain the biases.

- Heuristics & Biases & Judgement

The Original Three Heuristics

- **Representativeness:** People draw inferences based on **the degree of similarity** between features of a sample and features of a population from which it might have been drawn.

- **Availability:** People judge the probability of an event by **the ease with which instances can be brought to mind**.

- **Anchoring-and-adjustment:** People make estimates by **starting from an initial value** (perhaps suggested by the problem, or a partial computation) **and then adjusting,** often insufficiently in the direction of the correct answer.

The Representativeness Heuristic:

The gambler's fallacy

- People expect random sequences to even themselves out.
- People predict that the longer a streak of heads, the more likely a tail because it is due.
- As a result, lottery winners who chose numbers that had recently won shared the prize with fewer other players and hence earned more.

The Representativeness Heuristic –

The Conjunction Fallacy/The Linda Problem

- Linda is thirty-one 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.
- What is more probable for Linda?

  (A.) She is a bank teller.

  (B.) She is a bank teller and active in the feminist movement.
- Nearly 90% of respondents chose B. (N = 86)
- But A must be more likely because B is a subset of A.
- Explanation: The description of Linda is more representative of/similar to B.

The Availability Heuristic

- People judge the probability of an event by the ease with which instances can be brought to mind.
- Often generates reasonable estimates, but leads to biases when:
- **Some instances easier to retrieve.**
  - **Familiarity:** After hearing a list of male and female names, subjects erroneously thought there were more female names when the females were more famous, and vice-versa.
  - **Salience / vividness:** Seeing a traffic accident may have a bigger effect on belief about their likelihood than reading statistics in the newspaper.
  - **Associative network organization:** Easier to think of words that begin with r than words with r as third letter, so former incorrectly seems more common.

The Availability Heuristic

- People judge the probability of an event by the ease with which instances can be brought to mind.
- Often generates reasonable estimates, but leads to biases when:

- **Some events are easier to imagine:** If you imagine all the things that can go wrong during an expedition, it will seem more dangerous.

The Anchoring-and-Adjustment Heuristic

People make estimates by starting from an initial value (perhaps suggested by the problem, or a partial computation) and then adjusting often insufficiently in the direction of the correct answer.

What is 8 x 7 x 6 x 5 x 4 x 3 x 2 ?

An *incomplete* laundry list of heuristics and biases

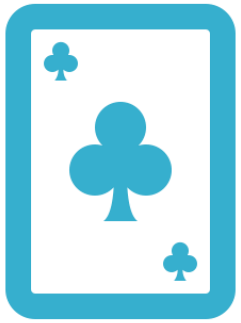
The Hot Hand Fallacy

- People perceive independent random signals as having too many streaks, and invent hot-hand stories to explain the pattern.

- Gilovich, Mallone, and Tversky(1985) surveyed 100 basketball fans at Cornell and Stanford.

- 91% believe that a player has a better chance of making a shot after having just made his last two or three shots than he does after having just missed his last two or three shots.

Let’s think about:



Gambler fallacy

Hot hand fallacy

The Illusion of Control

- People believe they have some control over chance events, especially when they think about the outcome.

- (Experiment) All subjects assigned a lottery ticket, but half received the three-digit ticket number in installments over three days. Several days later, subjects were given opportunity to trade ticket for a ticket from a different lottery with a better chance of winning. Those who received number in installments, **and therefore likely thought more about outcomes,** were less likely to trade, and indicated greater confidence about winning.

Overoptimism

- People are unrealistically optimistic about future life events.
- Possibly a consequence of illusion of control.

Table 1: *Unrealistic Optimism for Future Life Events*

Abbreviated event description	Measures of optimism: Mean comparative judgment of own chances vs. others' chances (%)[a,b]	Measures of optimism: No. of optimistic responses divided by no. of pessimistic responses[b,c]
Positive events		
1. Like postgraduation job	50.2***	5.93***
2. Owning your own home	44.3***	6.22***
3. Starting salary > $10,000	41.5***	4.17***
4. Traveling to Europe	35.3***	2.25***
5. Starting salary > $15,000	21.2**	1.56*
6. Good job offer before graduation	15.3**	1.42
7. Graduating in top third of class	14.2	1.02
8. Home doubles in value in 5 years	13.3*	1.78*
9. Your work recognized with award	12.6*	1.72*
10. Living past 80	12.5**	2.00**
11. Your achievements in newspaper	11.3	1.66*
12. No night in hospital for 5 years	8.5	1.23
13. Having a mentally gifted child	6.2*	2.26**
14. Statewide recognition in your profession	2.1	1.00
15. Weight constant for 10 years	2.0	.82
16. In 10 years, earning > $40,000 a year	− .7	.64*
17. Not ill all winter	− .7	.89
18. Marrying someone wealthy	− 9.1	.36*
Negative events		
19. Having a drinking problem	−58.3***	7.23***
20. Attempting suicide	−55.9***	8.56***
21. Divorced a few years after married	−48.7***	9.50***
22. Heart attack before age 40	−38.4***	5.11***
23. Contracting venereal disease	−37.4***	7.56***
24. Being fired from a job	−31.6***	7.56***
25. Getting lung cancer	−31.5***	4.58***
26. Being sterile	−31.2***	5.94***
27. Dropping out of college	−30.8***	3.49***
28. Having a heart attack	−23.3***	3.18***
29. Not finding a job for 6 months	−14.4***	2.36***
30. Decayed tooth extracted	−12.8	2.22***
31. Having gum problems	−12.4**	1.39
32. Having to take unattractive job	−11.6	1.84**
33. Car turns out to be a lemon	−10.0*	2.12**
34. Deciding you chose wrong career	− 8.8	1.43
35. Tripping and breaking bone	− 8.3*	1.66*
36. Being sued by someone	− 7.9	2.38***
37. Having your car stolen	− 7.3	2.94***
38. Victim of mugging	− 5.8	3.17***
39. Developing cancer	− 4.4	1.28
40. In bed ill two or more days	− 3.2	1.75*
41. Victim of burglary	2.8	1.21
42. Injured in auto accident	12.9*	.80

What do you think are the chances that the following events will happen to you?

Responded with probability relative to the average.

Confirmation Bias and Belief Polarization

- People perceive ambiguous information as supportive of their current beliefs.

- Confirmatory bias appears to arise to the extent evidence is ambiguous, and (relatedly) when the evidence can be selectively collected or scrutinized.

Belief Perseverance

- Inferences from data persevere even when the data are later completely discredited.

- To note, experiments in psychology allows lies, while it is the norm that experiments in behavioral economics doesn’t allow lies.

Illusory Correlation

- People perceive correlations that they expect to see even when the correlations aren’t really there.

- K&T argued that the availability heuristic explains illusory correlation.

Reactions from Economics

- First-wave reaction: Can we identify .anomalies. in economic settings?
  - Do biases persist with incentives / with repetition / in laboratory markets?
  - Answer: Usually yes.
- Second-wave reaction: How can we model these biases to incorporate them into economic analysis to predict when and how they matter?
- Third-wave reaction: Can we test predictions of the models in lab and field data?
- The Field data is almost exclusively in finance.
- In financial markets, the biases sometimes matter and sometimes not (due to arbitrage).