An Experiment on Assigning Probabilities

Bill is 34 years old. He is intelligent, but unimaginative, compulsive, and generally lifeless. In school, he was strong in mathematics but weak in social studies and humanities.

Rank from 1 to 8, with 1 = most probable:

1. Bill is an architect who plays poker for a hobby.
2. Bill is an architect.
3. Bill is an accountant.
4. Bill plays jazz for a hobby.
5. Bill surfs for a hobby.
6. Bill is a reporter.
7. Bill is an accountant who plays jazz for a hobby.
8. Bill climbs mountains for a hobby.
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 anti-nuclear demonstrations.

Rank from 1 to 8, with 1 = most probable:

1. Linda is a teacher in elementary school.
2. Linda works in a bookstore and takes Yoga classes.
3. Linda is active in the feminist movement.
4. Linda is a psychiatric social worker.
5. Linda is a member of the League of Women Voters.
6. Linda is a bank teller.
7. Linda is an insurance salesperson.
8. Linda is a bank teller and is active in the feminist movement.
Testing probability theory as a psychological model

Tversky and Kahneman’s experiment tests the match between probability theory and people’s estimates for conjunctive probabilities.

\[ P(A \cap B) \leq \min(P(A), P(B)) \]

For example, for Bill they gave:

- \( P(\text{Accountant}) \)
- \( P(\text{Plays jazz for a hobby}) \)
- \( P(\text{Accountant and plays jazz for a hobby}) \)
Questionnaires were given to two groups of subjects:

- Undergraduates at U. of British Columbia and Stanford with no background in probability or statistics.

- Graduates students at Stanford’s decision science program with several advanced courses.
Results for Bill:

1. (4.1) Bill is an architect who plays poker for a hobby.
2. (4.8) Bill is an architect.
3. (1.1) Bill is an accountant.
4. (6.2) Bill plays jazz for a hobby.
5. (5.7) Bill surfs for a hobby.
6. (5.3) Bill is a reporter.
7. (3.6) Bill is an accountant who plays jazz for a hobby.
8. (5.4) Bill climbs mountains for a hobby.
Results for Linda:

1. (5.2) Linda is a teacher in elementary school.

2. (3.3) Linda works in a bookstore and takes Yoga classes.

3. (2.1) **Linda is active in the feminist movement.**

4. (3.1) Linda is a psychiatric social worker.

5. (5.4) Linda is a member of the League of Women Voters.

6. (6.2) **Linda is a bank teller.**

7. (6.4) Linda is an insurance salesperson.

8. (4.1) **Linda is a bank teller and is active in the feminist movement.**
Results

- Virtually no difference between naive and expert subjects (more than 85% of each group ranked conjunctions as more probable).

- When the conjunction effect was pointed out, all but one subject acknowledged error (they understood how probability should work).
How do people decide probabilities?

Tversky and Kahneman’s hypothesis: they judge by representativeness.

Representativeness depends on

1. Having the essential category features

2. Not having too many distinctive features.

E.g., Linda is not believed representative of bank tellers, but is more representative of feminist bank tellers.
Representativeness differs from frequency:

- Updike is more is a more representative American writer than Mailer.

- Robins are more representative of birds than chickens
Experimental verification

Subjects were asked to rank the assertions about Bill and Linda by

the degree to which Bill (Linda) resembles the typical member of the given class.

Rankings were virtually identical.