Lecture 6
Keynes's Concept of Probability

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Scientific Thought II
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John Maynard Keynes

1883: Born in Cambridge, England

1904: B.A. Cambridge University

1914–18: World War I

1919: *The Economic Consequences of the Peace*

1921: *A Treatise on Probability*

1936: *The General Theory of Employment, Interest and Money*

1946: Died in Sussex, England

The meaning of probability (Chapter 1)

Examples of inconclusive arguments (by me)

- *Induction by simple enumeration:*

$$\frac{\text{All observed } A \text{ are } B}{\text{All } A \text{ are } B}$$

- *Method of hypothesis:*

$$\frac{\begin{array}{l}\text{If } H \text{ then } E\\ E\end{array}}{H}$$

What probability theory is about

- *In Metaphysics, in Science, and in Conduct, most of the arguments, upon which we habitually base our rational beliefs, are admitted to be inconclusive to a greater or less degree.* (3)
- The theory of probability deals with the degree to which arguments are conclusive.

Probability is a relation between propositions

$$\frac{h \text{ (premises)}}{a \text{ (conclusion)}}$$

- *Let our premises consist of any set of propositions h, and let our conclusion consist of any set of propositions a, then, if a knowledge of h justifies a rational belief in a of degree* α*, we say that there is a* <u>*probability-relation*</u> *of degree* α *between a and h.* (4)
- *In my notation:* $p(a|h)$ is the degree of belief in a that is rational given h.
- In ordinary speech we often say a *conclusion* is probable or improbable, e.g. "It will probably rain tomorrow." What we mean is that it is probable given our evidence.

Objectivity

- Probability is relative to a body of knowledge, which is different for different people.
- *To this extent, therefore, probability may be called subjective. But in the sense important to logic, probability is not subjective ... A proposition is not probable because we think it so. When once the facts are given which determine our knowledge, what is probable or improbable in these circumstances has been fixed objectively, and is independent of our opinion.* (4)
- *When we argue that Darwin gives valid grounds for our accepting his theory of natural selection, we do not simply mean that we are psychologically inclined to agree with him ... We believe that there is some real objective relation between Darwin's evidence and his conclusions, which is ... just as real and objective, though of a different degree, as that which would exist if the argument were ... demonstrative.* (5)

Probability is part of logic (3)

If logic investigates the general principles of valid thought, the study of arguments, to which it is rational to attach some weight, is as much a part of it as the study of those which are demonstrative.

Measurement of probabilities (Chapter 3)

Keynes's view

- A probability is *measurable* if it has a numeric value.
- Keynes accepted that *some* probabilities are measurable.

  Example (from Laplace): The probability that the balls in urn C are black, given that two of urns A, B, and C have white balls and the other has black balls, is $1/3$.
- Keynes claimed that many probabilities are *not* measurable, i.e., they don't have a numeric value.

An unmeasurable probability (29)

We are out for a walk—what is the probability that we shall reach home alive? Has this always a numerical measure? If a thunderstorm bursts upon us, the probability is less than it was before; but is it changed by some definite numerical amount?

Statistics may be inapplicable (29)

1. *There might, of course, be data which would make these probabilities numerically comparable; it might be argued that a knowledge of the statistics of death by lightning would make such a comparison possible. But if such information is not included within the knowledge to which the probability is referred, this fact is not relevant to the probability actually in question.*
2. *In some cases, moreover, where general statistics are available, the numerical probability which might be derived from them is inapplicable because of the presence of additional knowledge with regard to the particular case.*

   My example: Statistics can tell you what proportion of people of your age, gender, etc., live to age 70. But you also have other relevant information about yourself, e.g., your health and your ancestors' longevity. So your probability of living to 70 won't equal the statistical proportion who do.

Non-comparable probabilities

- The probability of getting home alive from a walk with a thunderstorm is less than without a thunderstorm. Keynes says these probabilities are *comparable*, even though they don't have numeric values.
- Keynes claimed that in other cases the probabilities aren't even comparable, i.e., there is no fact as to which is larger than the other.
- My elaboration of an example of Keynes (29–30):

  H: All crows are black.

  E_1: 1000 crows in Illinois were examined and all were black.

  E_2: 250 crows in Illinois and 250 in California were examined and all were black.

  E_1 contains more observations but E_2 is more varied. Keynes would say $p(H|E_1)$ and $p(H|E_2)$ aren't comparable.

Questions

1. According to Keynes:
   (a) What does it mean to say that the probability of *a* given *h* is α?
   (b) In what sense is it true that probability is subjective? In what sense is this not true?
2. Does Keynes think probability theory is part of logic? What is his reason?
3. Give an example of probabilities that Keynes would say are comparable but not measurable.
4. Give two reasons why, according to Keynes, the probability that you will live to be 70 years old cannot be measured by collecting statistical data.
5. Give an example of probabilities that Keynes would say are not comparable.

Reference

John Maynard Keynes.
A Treatise on Probability.
Macmillan, 1921.
On Google books.
Numbers in parentheses are page numbers of this book.