Law of Likelihood 2
Application to *The Origin of Species*

Patrick Maher
Philosophy 471

Fall 2006

The law of likelihood (again)

Let H_1 and H_2 be incompatible hypotheses. Evidence E favors H_1 over H_2 iff the inductive probability of E is higher given H_1 than given H_2.

- Even when inductive probabilities lack numeric values, one may be higher than another.
- Hence the law of likelihood can be used even when the inductive probabilities lack numeric values (as they often do).
- I'll illustrate this by discussing some evidence from Charles Darwin, *The Origin of Species*, 1st edition 1859. (Facsimiles in paperback and online).

The theories

Independent creation

- Each species was created independently of other species.
- Species may be modified by the environment, but this can never go so far as to make a new species.

Darwin's theory

- The innumerable species that exist were not created separately but have resulted from modifications to one or a few primitive species.
- The cause of the modifications is *natural selection*: The individuals of each generation vary somewhat, and more are born than can survive, so only those that are best adapted will survive and reproduce. Repetition of this over many generations produces new species.

Species and varieties

The distinction is unclear:

Certainly no clear line of demarcation has as yet been drawn between species and sub-species—that is, the forms which in the opinion of some naturalists come very near to, but do not quite arrive at the rank of species; or, again, between sub-species and well-marked varieties, or between lesser varieties and individual differences. These differences blend into each other in an insensible series; and a series impresses the mind with the idea of an actual passage. (p. 51)

As a result, naturalists often don't agree where to draw the line.

How many of those birds and insects in North America and Europe, which differ very slightly from each other, have been ranked by one eminent naturalist as undoubted species, and by another as varieties, or, as they are often called, as geographical races! (p. 48)

Let U = the distinction between species and varieties is unclear,
N = Darwin's theory that species arose by natural selection.

U is expected given N

- Individual differences accumulate to produce varieties.
- These varieties gradually diverge. At some point they become so different we call them different species.
- But they must pass through an intermediate stage where it isn't clear whether to count them as different species or not.
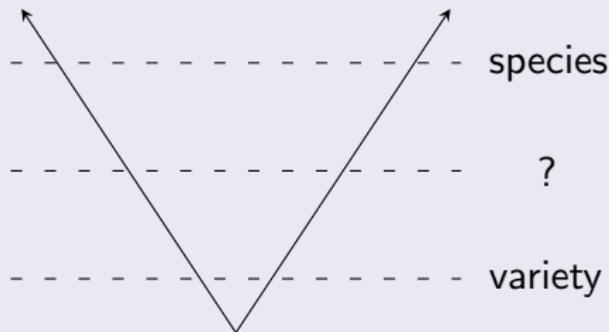
Let C = the theory of independent creation of each species.

U not expected given C

- There is a fundamental difference between species and varieties; only the former have been independently created.
- So there is no reason to expect that the distinction would be unclear.
- A creationist can say the creator wanted it this way, for some reason unknown to us. But C gives no reason to expect this.

Application of the law of likelihood

- Since U is expected given N, but not given C, the inductive probability of U is higher given N than given C.
- So by the law of likelihood, U favors N over C.

Rudimentary organs

Organs or parts in this strange condition, bearing the stamp of inutility, are extremely common throughout nature. . . . In very many snakes one lobe of the lungs is rudimentary; in other snakes there are rudiments of the pelvis and hind limbs. Some of the cases of rudimentary organs are extremely curious; for instance, the presence of teeth in foetal whales, which when grown up have not a tooth in their heads; and the presence of teeth, which never cut through the gums, in the upper jaws of our unborn calves. It has even been stated on good authority that rudiments of teeth can be detected in the beaks of certain embryonic birds. Nothing can be plainer than that wings are formed for flight, yet in how many insects do we see wings so reduced in size as to be utterly incapable of flight, and not rarely lying under wing-cases, firmly soldered together! (pp. 450f.)

Let R = rudimentary organs are common.

R not expected given C

I have now given the leading facts with respect to rudimentary organs. In reflecting on them, every one must be struck with astonishment: for the same reasoning power which tells us plainly that most parts and organs are exquisitely adapted for certain purposes, tells us with equal plainness that these rudimentary or atrophied organs, are imperfect and useless. In works on natural history rudimentary organs are generally said to have been created ''for the sake of symmetry,'' or in order ''to complete the scheme of nature;'' but this seems to me no explanation, merely a restatement of the fact. (p. 453)

R expected given N

- Species inherit these organs from an ancestor species, for whom they were useful. The organs are now useless because the species has changed.
- Useless organs may be reduced in size to conserve energy, or because the organ is harmful in the new situation (e.g., wings of beetles on oceanic islands).
- They aren't entirely eliminated, or not for a long time, because natural selection works slowly.

On the view of descent with modification ... the existence of organs in a rudimentary, imperfect, and useless condition ... might even have been anticipated. (pp. 455f.)

Application of the law of likelihood

- Since R is expected given N, but not given C, the inductive probability of R is higher given N than given C.
- So by the law of likelihood, R favors N over C.

Other evidence

Darwin's book presents a vast amount of other evidence that can be analyzed similarly. For example:

- *Paleontology:* New species have appeared slowly, one after another, with intermediate strata containing intermediate fossil forms.

- *Geographic distribution:* Species on one continent are related to each other and different to those on other continents, regardless of climate and terrain. Oceanic islands have unique species that are related to those on the nearest continent.

- *Morphology:* Parts used for utterly different purposes in different species have the same structure, e.g., the arm of a man, leg of a horse, wing of a bat, flipper of a porpoise.

- *Embryology:* Species that are very different as adults are extremely similar as embryos.

1. Does the lack of a sharp distinction between species and varieties favor natural selection over independent creation as the origin of species? Justify your answer using the law of likelihood.

2. Does the existence of rudimentary organs favor natural selection over independent creation as the origin of species? Justify your answer using the law of likelihood.