From Specifications to Programs: Induction in the Service of Synthesis*

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[Induction is] utterly vicious and incompetent.
— Francis Bacon (1620)

I maintain that many of our inductive inferences
have all the certainty of which human knowledge is capable.
Is the law of gravitation one whit less certain than
the conclusion of the 47th proposition of the First Book of Euclid?
...Physical generalizations are established by the Method of Difference
and as actual *Laws of Nature,*
admit, I conceive, of no doubt.
— T. H. Fowler (1869)

Inductive Reasoning...
the glory of Science...
the scandal of Philosophy.
— C. D. Broad (1926)

I am convinced that induction must have validity of some kind of degree,
but the problem of showing how and why it is valid remains unsolved....
Until it is solved, the rational man will doubt whether his food will nourish him,
and whether the sun will rise tomorrow.
— Bertrand Russell (1927)

Induction plays no part whatever in science–
that there is no inductive method and that
nothing approximating to inductive inference is used.
—J. O. Wisdom (1952)

Abstract. The deductive synthesis of programs from formal specifications can be aided by various forms of induction: *Summative*, or *complete*, induction is the deductive technique of reasoning by cases and plays an important role in creating conditionals. *Recursive*, or *mathematical*, induction is a deductive technique for reasoning about an infinite number of cases; it is used in the creation of loops, and is often necessary for establishing properties of data types. *Eduction*, or analogical reasoning,

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helps reduce the amount of work needed to generate a program, when similar programs already exist. *Ampliative*, or *incomplete*, induction is the process by which one generalizes from a finite number of instances; it can help the synthesizer guess what statement is needed and to verify the correctness of suggestions.