

Klahr, D. (2001) Directions to “Eureka!” *Science*, 292, 2009

Dear Editor:

Your recent editorial “An Algorithm for Discovery” *Science*, 4/6/01, v. 292, p. 13. presents a tongue in cheek flow diagram, as well as a (presumably) more serious set of informal heuristics (a.k.a. “principles”), for the process of scientific discovery. I find it surprising and somewhat disappointing that *Science* would treat the psychology of discovery in such an informal and amateurish fashion.

Einstein did say, as your editorial quotes him: “The whole of science is nothing more than a refinement of every day thinking” But he went on to say much more, and, in effect, suggested a program of further investigation in the area that we now call cognitive science. The full quotation reads as follows:

“The whole of science is nothing more than a refinement of every day thinking. It is for this reason that the critical thinking of the physicist cannot possibly be restricted to the examination of concepts of his own specific field. He cannot proceed without considering critically a much more difficult problem, the problem of analyzing the nature of everyday thinking.  
(Einstein, 1936, p.59)

In the more than 60 years since Einstein made this remarkable statement, the cognitive sciences have made substantial advances our understanding of the “difficult ... problem of analyzing the nature of everyday thinking”.

At the same time that we have gained scientific knowledge about human thinking processes, we have also learned about how those processes are used in scientific discovery. Although this might be surprising and disconcerting to those who view the process of scientific reasoning as ineffable and unknowable, the connection between everyday thinking and scientific thinking is -- as Einstein correctly suggested -- more in the detail than in anything fundamental.

“The scientific way of forming concepts differs from that which we use in our daily life, not basically, but merely in the more precise definition of concepts and conclusions; more painstaking and systematic choice of experimental material, and greater logical economy.” (*The common language of science*, 1941, reprinted in Einstein, 1950, p.98)

Several decades of research on the psychology of scientific discovery process have revealed how normal cognitive processes enable humans to generate the "precise definitions," "systematic choice of experimental material," and "logical economy" that Einstein identifies as the hallmarks of scientific thought (For reviews of this extensive literature see Feist & Gorman, 1998; Klahr, 2000; Klahr & Simon, 1999; Zimmerman, 2000). Clearly, if *Science* is interested in publishing ideas about the scientific discovery process, it can do better than devoting its scarce pages to informal anecdotes that trivialize, rather than rigorously investigate, the very foundation of its topic.

Sincerely,

David Klahr

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