The Analogy of Revolution

The word, revolution, has many meanings. There are apparent circular movements in the sky, and so Copernicus entitled his book, On the Revolutions of the Heavenly Spheres. We live in an age of mechanical motors, and so we speak of rpm, revolutions per minute. Ours is thought by some to be a time of troubles, by others to be a time of great political achievement, but all refer to the French, the Russian, and the Chinese revolutions. Besides astronomical, mechanical, and political revolutions, there are also revolutions in science. Copernicus not only wrote on revolutions in the heavens but also produced a revolution in the thought of astronomers. Finally, such revolutions in science are a recurrent phenomenon; they have a shape and texture of their own; and so Thomas Kuhn has written a book entitled, The Structure of Scientific Revolutions.

Chicago: University of Chicago Press, 1962, 1970.

I must dwell, however, briefly and summarily, on Dr Kuhn's account, for it will supply the analogy for the topic of these lectures, REvolution in Roman Catholic Theology?

A scientific revolution, then, occurs in a scientific community, in the group of those that practise some scientific specialty, and specifically not in those that read about the science in the newspapers, or those that study or teach the science in a university, but in those actively engaged in advancing the science. This notion of the scientific community is of fundamental importance. It is a sociological concept of science, locating the science not in books or periodicals, not in the mind of this or that man, but in the group of men at the cutting edge of a developing science and gradually moving from the tension and opposition of disagreement to the unison of a consensus. The word, revolution, is apt to summon up images of proclamations, impassioned, speeches, tumults, arrests, imprisonment, executions. But the noise and bloodshed that may be associated with the mass phenomena of political revolutions, have nothing to do with scientific revolutions. As Dr Kuhn remarks, they may occur and no more than twenty-five people xxx will know about their occurrence.

As a first step locates the scientific revolution in a scientific community, so a second step introduces a distinction between cumulative and revolutionary developments. Cumulative developments are the normal products of a developing science. They may be brilliant. They may have cost years of painstaking research. They may involve adjustments here and there in the established body of the science. But, on the whole, they fit into what has gone before. In an edifice in process of construction they may pierce a window in a blank wall, xxxx remove an inconvenient partition, even add a wing that had not been planned. But there is no large-scale xxxxxxxx demolition followed by a reconstruction in accord with a new master plan. Such are cumulative developments in a science. In contrast, revolutionary developments do resemble processes of demolition and reconstruction. As Dr Kuhn has written:

> More clearly than most other episodes in the history of at least the physical sciences, these [viz., the major turning points in scientific development associated with the names of Copernicus, Newton, Lavoisier, and Einstein] display what all scientific revolutions are about. E ch of them xx necessitated the community's rejection of one time-honored scientific theory in favor of another incompatible with it. Each produced a shift in the problems available for scientific scrutiny and in the standards by which the profession determined what should count as an admissible problem or as a legitimate problem-solution, And each transformed the scientific imagination in xxx ways that we shall need xxxx ultimately to describe as a transformation of the world within which scientific work was done. Such changes, together with the controversies that almost always accompany them, are the defining characteristics of scientific revolutions.

Op. cit., p. 6.

Dr Kuhn, then, assigns three defining characteristics of a revolutionary development in xtx a science. First, it replaces a time-honored theory with another theory incompatible with its predecessor. Secondly, it makes irrelevant a previous range of problems and problem-solutions, and replaces it with a new range. Thirdly, it introduces, so to speak, a new xxxl world within which the scientist does his thinking. So one might addx, Newtonian mechanics bestowed on that subject a structure that resembled Euclid's Elements. It presented physicists with a new range of problems with new criteria for solutions ofproblems while antiquating earlier concerns. It placed man in a material universe so subject to known, quantitative law that accurate calculations of the past and predictions of the future became possible.

One may ask, however, what remains to be done once a revolution has occurred. The revolution sets up universal laws. The subsumption of parxticulars under universals is a mere matter of logic. Yet we have spoken of cumulativxe as well as revolutionary developments of science, and surely no one would conceive the simplest of logical operations to constitute a scientific development.

The answer to this question is, I believe, the most bx brilliant and original of Dr Kuhn's contributions to the theory of xxxxxxxx scientifxic development. In fact, the answer he himself gx gave was, itself, in process of development. In the first edition of his work, he spoke of 'paraxdigms.' In a postscript added in the second edition, he admits that his earlier thought lacked clarity and precision and, xxxxxx where before he spoke of 'paradigms', he now prefers to speak of exemplars. But however halting his speech may have been, what he meant is, I believe, quite clear.

If I my employ I have elsewhere developed, just as the ascent from data to the formulation of a universal law and the working out of a system requires a long and

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B. Lonergan, Insight, London and New York 1957.

arduous process in which insights gradually cumulate, coalesce, complement and correct one another, so too the application of a law and still more of a system is only incidentally and indeed trivially a matter of subsuming particulars under universals.

As the ascent to the universal is long and difficult, so too is the descent back to particulars. For the descent calls for its own brand of assiduity and inventiveness and, perhaps, for that rarer brand of patience that keeps working out ever new solutions to meet to meet the ever varying particular cases.

Nothing makes a point more effectively than the invocation of personal experience and, as I cannot expect all of you to have had the same experiences, I shall offer a series of illustrations. My own contemporaries among you may have been brought up on Hall and Stevens' presentation of Euclid's <u>Elements</u>. If so, you will recall that over and above the concatenation of theorems demonstrated and problems solved, there periodically were added questions aimed at sharpening the wits of students. In fact, they were just further problems to be solved and further theorems to be demonstrated on the basis of the bookwork. But the solutions and demonstrations required were no simple matter of subsuming the particular under the universal. Real ingenuity was demanded. For no little time one floundered about in one's stuggles with these mystifying 'riders', and only eventually did one learn the various tricks of joining the points P and Q or drawing a circle through the points P, and Q, and R, till the desired solution or proof popped into view.

Now the riders to Euclid's <u>Elements</u> are only one instance of a general case. Plenty of ingenuity, over and above the bookwork, was needed to do sums in Arithmetic, to solve problems in Algebra, to establish identity by transformation in trigonemetry. When one got away from mathematics, the same sort of thing kept one uneasy in physics and chemistry.

There were ever further questions. They were appended in fine print at the end of each chapter and at times even oftener. No more that a remote and general solution could be wrung out of the chapter one xxx had just mastered. With little mercy it was left to the student's diligence and inventiveness to figure out these further answers fork himself.

I have been endeavoring to illustrate two different kinds of scientific development. There are revolutionary developments that advance a science to a new plateau. There are cumulative developments concerned to map the platexau in all its significant detail. x Both are true developments, real advances in understanding, for both call for new insights and neither can be achieved by subsuming particulars under already known rules.

Let me here xxxxxxxxx interrupt my exposition to throw in a remark that may reassure you, however remxote it may sseem, that there is a theological goal in view. It is often objected that courses in theology are very little help, xxxx when the student leaves the classroom to do field-work, or when the graduate proceeds from his school to the ministry. So may I ask, in passing, whether we may not have something to learn from mathematicians, and physicists, and chemists. Do we think of the ministry or of field-work as the simple matter of subsuming particulars under universals, or do we effectively acknowledge that it calls for its own brand of intelligence and inventiveness? And if the latter is our view, do xxx our acadxemic courses contain, not indeed any slavish and inept imitation, but some analogous adaptation of the questions appended to chapters in textbooks on physics and chemistry?

There remains just one more point and we shall have done with our borrowing from Dr. Kuhn. It is easy enough to see how the abstruse revolutionary development gives rise to the xxxxxxxxx mass of cumulative developments that give the general view its concrete meaning and its varied applications. But there is also thexx inverse problem. How does the series of cumulative developments give rise to a new revolutionary development? Here, we must resort to the sociological approach.