

Science and Society

Past, Present, and Future

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V Revolutions and Copernican Revolutions

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I PROPOSE to ruminate about Copernican revolutions—not *the* Copernican Revolution (although no chapter of intellectual history could be more fascinating) but about the concept of revolution Copernican in character and scope. I aim to do this partly in order to think more clearly about past and present revolutions, and partly in order to speculate about a future revolution. But in good part, also, it is my purpose simply to explore an intellectual and historical category so important that each of its few members, rich in drama and instruction, marks a critical turning for human kind.

Revolution in General

Philosophers and scientists often propose views they honestly believe to be revolutionary; but the proposers are rarely themselves active revolutionaries. “Up to now philosophers have only *interpreted* the world differently,” Marx complained in a famous note to himself, and added, “the point, however, is to *change* it.”

All of us would like to change the world; very few are they for whom reality does not fall far short of some ideal. Whether we believe (or ought to believe) that what is needed is revolutionary change, or changes only possible through revolution, depends, of course, upon what is meant by “revolution.” It is a term bandied about in these days with high irresponsibility.

Most contemporary interest centers on political and social revolutions. We will think more clearly about such revolutions, I submit, if first we examine the concept of revolution more abstractly, its essence and its kinds, subsequently drawing some conclusions about the reality of revolution on the contemporary scene, and the possibility of certain revolutions in the future.

The root meaning of “revolution” is that of turning, turning completely around. So the planets perform revolutions about the sun, and for many engines an important index of the level of activity within is the number of revolutions per minute. In this pure sense, a body moves in one revolution around a complete circular or oval course, returning substantially to the position from which it began. In pursuing such a course, obviously, the revolving body at one point occupies a position diametrically opposed to that from which it started, and this feature of such movement, I presume, led to the use of the term to indicate a total change of circumstances of whatever was in revolution, a drastic alteration of character, or system, or conditions. “Religions, and languages, and forms of government, and usages of private life, and modes of thinking, all,” says Lord Macaulay (in Moore’s *Byron*) “have undergone a succession of revolutions.” It is this feature that has become paramount in our use of the concept; as often happens in language, usage at first metaphorical becomes literal at last.

Nowhere is the use of this dead metaphor, as indicating a drastic turnabout of system or condition, more useful to us than in the sphere of politics; so “revolution” comes to have, more than any other tone, a political one. Ask a common man what a revolution is, and he will tell you, rightly (in so many words), that it is a radical change of government, the overturn of an established political system and its replacement by another. There have been many of these in Western history, but the greatest three of modern centuries, which will be allowed by all, I think, to qualify as paradigms, are (in chronological order): (a) the English (Glorious) Revolution of 1688, in which royal despotism is ended, constitutional government established, the supremacy of the Houses of Parliament fixed, and the Bill of Rights declared; (b) the French Revolution of 1789, in which absolute monarchy is brought down, the Bastille as its symbol is stormed, and the first French Republic

established; (c) the Russian Revolution of 1917, in two chapters, as a result of which the reign of the Tsars is overturned, the Soviet Socialist State established.

But of course, all important revolutions have not been political. We frequently hear reference to the *scientific* revolution, to the *industrial* revolution, to the so-called *managerial* revolution, and others. Allowing without quarrel that these were indeed revolutions, what made them so? Many great changes and discoveries, thrilling in dimension, enormous in impact, are yet not revolutions. The discovery of the New World by Christopher Columbus, though monumental in import, is not the Columbian revolution. The establishment of the science of bacteriology, through the discovery of microorganisms by Louis Pasteur, although among the greatest scientific advances of all time, is not thought of as the Pasteurian revolution. For Christianity the splitting off of the Protestant sects has had consequences too wide and too deep ever to catalogue, yet we do not view those developments as revolutionary; it is the Protestant *Reformation* to which we refer. The real democratization of England came not when King James II was deposed in 1688, but when the great body of its citizenry was enfranchised as the result of legislation in the 1830s and 1860s—the great *reform* bills. Most great advances are rightly viewed as reforms; some, a very few, as revolutions. If we could say somewhat more clearly how this distinction is to be drawn, our political discourse might be much sharpened.

Revolution and Reform

The key to the distinction needed here is to be found, I suggest, in the original idea of a revolution as a turning around. Many changes, some very great, move us crisply from one position to another, from one theory to another, from one state of development to another. A very few changes do that and something else: they overturn an established system, scientific or political, and replace it with another having an essentially different nature, essentially different principles of organization. The splitting of the atom, and the consequent development of nuclear power, brought developments in science and human society, for good or ill, of extraordinary character—yet those advances did not alter fundamentally the already existing theoretical understanding of matter

and energy. New scientific instruments—the telescope for Galileo, antibiotic drugs for recent medicine, the bubble chamber for nuclear physics—make possible “breakthroughs” of exhilarating dimensions, but they are not revolutionary, although they are sometimes given that name, through a sort of rhetorical expansion. Similarly, some revolutions, so-called, in many nation-states—Latin America has provided the most well-known examples—have changed some things sharply, and yet in most fundamental respects have altered not very much in the lives of the citizens. *Plus ça change, plus c’est la même chose*.

Revolutions clearly deserving the name are not so common, after all. The industrial revolution really is entitled to that appellation. A complex chain of events, over a fairly extended period, resulted in a complete turnabout in the ways most things were to be made, and in the ways most people were to work and to live their lives. The underlying principles of economic organization were, for most, diametrically altered—from individual to collective production, from rural to urban life. The discovery of non-Euclidean geometry, although perhaps seldom thought of as revolutionary, was truly that, in changing the basic conceptions with which many aspects of geometry, and later physics, were to be dealt with. And the Glorious Revolution, although essentially bloodless, and far from introducing full democracy, was indeed a profound reversal of the principles of government in England. The shift in real authority from the Crown to the Parliament—though its immediate impact was only moderate—was of the most fundamental import. Government, in England, from that time forth, had a very different character, had to be thought about, and acted toward, in very different ways.

Intellectual discourse does frequently distinguish between the *coup d’état* and the real revolution; the line may be hard to draw sharply, but the distinction is appropriate and important. Of course, those who successfully usurp authority will often claim to be revolutionaries in some honorific sense; long experience instructs us to take such rhetorical flourishes with high skepticism.

Contemporary Revolutions

There is much talk about revolution in the contemporary West. Is all of it no more than rhetoric? Whether the goals or

proposals of particular persons or movements do indeed call for a fundamental change in the principles of social organization is a matter to be determined in each case separately, of course; but I submit here some observations concerning two kinds of “revolution” much discussed. The first of these I shall call simply “Marxist,” the second, for the sake of a name, “populist,” although that term is now not much used. I confine myself to the American scene, but what I say about it can, I think, be much generalized.

Of Marxist revolution not much needs to be said here. I touch not at all on the question of whether such a revolution would be justified or right. What seems clear beyond doubt is that, where events transpire as Marx and his disciples intend (and expect) that they shall, the process *is* genuinely revolutionary. Called for is a thorough overturn of existing economic arrangements, a fundamental change in the principles of possession and management of productive property, and, consequently, the complete elimination of wage labor, and radical changes in the conditions of human work. At least in the economic sphere (and perhaps in all spheres, if Marx was right in holding that economics is the substructure of an edifice of which politics, law, religion and the arts are but superstructure) the basic principles of human organization are to be wholly—dramatically—altered. Whether events in the Soviet Union, or China, or Cuba, have indeed realized, or are now in the process of realizing, this transfiguration, is a matter of much controversy. And whether that is a transfiguration we want, or ought to want, is far from settled. But the honestly professed ideal of a proletarian uprising against the exploitations of an oppressive capitalist economic order is, however well grounded in theory or in fact, unquestionably revolutionary in conception.

The “populist” aspirations of contemporary American and European radicals are not, I think, in the same case. Under the heading “populist” I mean to clump together a variety of organizations and movements which hold, in common, that the abuses and inhumanities of Western governments—the American government most notably—morally demand their overthrow, and their replacement by new regimes genuinely in the service of the people. Such populist revolutionaries share many of the critical views of Marxists—a detestation of private industrial abuses, of gross economic

inequalities, and the like. But populists often do not share Marxist convictions about the inevitability of dialectical advance, or the underlying Marxist materialism, and consequent economic determinism. Nor need they accept the Marxist orthodoxies regarding property and its rightful appropriation. Indeed, many American populists are sharply anti-Marxist, and contemptuous of the dogmatism of contemporary Communist parties.

Now again I do not speak here of the rightness of populist principles, or the justifiability of their often bitter criticism of existing governments and leaders. I ask here only whether the spirit of these movements is genuinely revolutionary. The answer, it appears to me, must be no. American government, they contend, is simply not living up to its promises. It purports to be by the people, and for the people, but (say they) turns out in fact to be manipulative, unresponsive, and, for some large minorities, cruelly oppressive. Therefore it is time to make a revolution, in the true spirit of Jeffersonian democracy. The spirit of the new populists—however much the practice of some may fail to accord with it—is best expressed in the original motto of Students for a Democratic Society (SDS)—“Let the people decide.”

Much in these movements seems to me altogether honorable, admirable, and right. But when the speechmaking is over, and the several concrete proposals and plans of action are put before us, I simply do not find much that is revolutionary in them. Of course representative institutions, when they prove unresponsive, should be made more responsive; of course the exploitation and oppression of minorities, where it exists, needs to be rooted out, and so on. Great changes in American government and society—and elsewhere in the West—are surely called for, as are the efforts to bring them about. But these are not revolutionary changes, they are reforms which, as envisaged, would more fully realize the principles to which virtually all reasonably enlightened citizens honestly subscribe. If (what seems rather unlikely) the present American government, or British government, were overthrown by sincere, radical populists, and new representative assemblies convened, and so forth, it may be that policy changes for the better would come more rapidly than is likely under existing institutions. In view of the procedural insensitivities (and in some cases, the fanaticism) of some populist leaders, that is genuinely doubtful.

But even supposing that such happy consequences would follow an uprising and overthrow, there is little doubt that that overthrow would deserve the name of *coup*, not revolution.

It is worth noting, in passing, that overt efforts to effect such a *coup*, however romantic and unlikely to succeed, tend, in fact, to reduce rather than to increase the responsiveness of existing institutions. By raising general concern about collective self-preservation, such efforts tend to exacerbate, rather than to mitigate, the repressive inclinations of the present order.

Copernican Revolution

Some revolutions are of a very special kind, and that special nature is properly identified by calling them “Copernican.” Reflection upon these Copernican revolutions is particularly appropriate just now. If we can isolate that feature or set of features which sets them apart from all other revolutions, social or scientific, we may be the better prepared for a new Copernican revolution which—as it seems to me—is in the offing.

The first self-conscious Copernican revolution was that of Copernicus. He and his successors, though often guarded in statement, knew it for what it was. *De revolutionibus orbium coelestium* (*On the Revolutions of the heavenly spheres*) is the accepted title of his great work; but there is speculation that he intended to call his book *De revolutionibus* simply—which might, indeed, have been more fitting. Many have pointed to the prefatory note in that work, advising the reader that the “hypothesis” of the book need not be taken as an assertion of fact, but instead as an intellectual tool, only. One would then read *De revolutionibus* not as claiming that the Earth moves, but as the introduction of a mathematical device in which, for purposes of calculation, and for the simplest explanation of the observed behavior of the planets, we do no more than change the origin of the coordinates of our grid. That was not Copernicus’s view; the suggestion itself, inserted and retained by others, was not his. A thoughtful reader of *De revolutionibus* cannot miss Copernicus’s genuinely revolutionary intent. After noting the speculations of Pythagorean astronomers, and others of earlier times, he writes:

I too began to think of the mobility of the Earth; and though the opinion seemed absurd, yet knowing now that others before me had been granted freedom to imagine such circles as they chose to explain the phenomena of the stars, I considered that I also might easily be allowed to try whether, by assuming some motion of the Earth, sounder explanations than theirs for the revolutions of the celestial spheres might so be discovered. [*De Revolutionibus*, Book I. All quotations here are from a translation by John F. Dobson and Selig Brodetsky, published in 1947 by the Royal Astronomical Society, London, from an almost perfect copy of the first edition of the work.]

This as a preliminary. By the time Copernicus is halfway through the first book of *De revolutionibus* he has shown that by transferring the motion of the Sun to the Earth the risings and settings of the fixed stars will be unaffected, but the observed peculiarities in the behavior of the planets (etymologically: *wanderers*)—their apparent retrogressions and hoverings—will be explained as due “not to their own proper motions, but to that of the Earth, which they reflect.” Finally, he says straightforwardly, “we shall place the Sun himself at the center of the Universe.” The resultant system is not only elegant and harmonious; it is what we will accept if only, in his words, “we face the facts, as they say, ‘with both eyes open.’”

The theory is, indeed, revolutionary. An entirely new set of principles, a new perspective, was to govern our thinking about ourselves, and our universe, thenceforth. With Copernicus’s shift in thought men were to change their conception of the structure of the world; not the Earth, but some other body or bodies, far distant, is that about which things in fact revolve. Revolutionary it was beyond doubt, and for the Christian world view of the time it was plain heresy.

It is not, however, the greatness of the shift, or the power of its impact, that marks that revolution as, in the fullest sense, *Copernican*. What was singularly extraordinary, and specifically Copernican about these conceptual changes was this: what had previously been viewed as movement “out there” recognized and measured by fixed observers “down here” now came to be understood as part of a larger system of movements in which neither

observed nor observers are stationary. The core passage in *De revolutionibus* is splendidly simple in its presentation of the reversal:

A seeming change of place may come of movement either of object or of observer, or again of unequal movements of the two (for between equal and parallel motions no movement is perceptible). Now it is Earth from which the rotation of the Heavens is seen. If then some motion of Earth be assumed it will be reproduced in external bodies, which will seem to move in the opposite direction.

Changes in apparent position previously attributed only to the movement of celestial bodies were now to be understood as due in great part to the characteristics of the observer.

“I ascribe movement to the earthly globe,” Copernicus wrote to Pope Paul III, and as soon as some people hear that, he observed, “they will cry out that, holding such views, I should at once be hissed from the stage.” But no amount of hissing could make the earthly globe stand still, or return us to a Ptolemaic understanding of the movements of the spheres without. The notion that what other things seem to be, seem that way because we are in the condition that we are, is uniquely Copernican. It is a deep and powerful idea, and its impact was bound to reach well beyond the sphere of astronomical science.

Two More Copernican Revolutions

If the first self-conscious Copernican revolution was that of Copernicus, the second was that of Immanuel Kant. Of the great modern philosophers he was the first fully to grasp the force of the Copernican hypothesis generalized. And quite explicitly he introduced his revolutionary account of human knowledge (in the *Preface* to the Second Edition of the *Critique of Pure Reason*) as Copernican in spirit. What we know, he argued, we are able to know partly because the objects of our knowledge have the attributes they do, and partly because we, as knowing subjects, provide the frame for knowing that we do. All phenomena, said he in effect, are the result of a partnership of knower and known, as the apparent movements in the heavens are the result of the movements of both the celestial bodies and that of the Earth. He wrote:

Hitherto it has been assumed that all our knowledge must conform to objects. But all attempts to extend our knowledge of objects by establishing something in regard to them *a priori*, by means of concepts, have, on this assumption, ended in failure. We must therefore make trial whether we may not have more success in the tasks of metaphysics, if we suppose that objects must conform to our knowledge. This would agree better with what is desired, namely, that it should be possible to have knowledge of objects *a priori*, determining something in regard to them prior to their being given. We should then be proceeding precisely on the lines of Copernicus' primary hypothesis. Failing of satisfactory progress in explaining the movements of the heavenly bodies on the supposition that they all revolved around the spectator, he tried whether he might not have better success if he made the spectator to revolve and the stars to remain at rest. A similar experiment can be tried in metaphysics, as regards the *intuition* of objects. If intuition must conform to the constitution of objects, I do not see how we could know anything of the latter *a priori*; but if the object (as object of the senses) must conform to the constitution of our faculty of intuition, I have no difficulty in conceiving such a possibility. Since I cannot rest in these intuitions if they are to become known, but must relate them as representations to something as their object, and determine this latter through them, either I must assume that the *concepts*, by means of which I obtain this determination, conform to the object, or else I assume that the objects, or what is the same thing, that the *experience* in which alone, as given objects, they can be known, conform to the concepts. In the former case, I am again in the same perplexity as to how I can know anything *a priori* in regard to the objects. In the latter case the outlook is more hopeful. For experience is itself a species of knowledge which involves understanding; and understanding has rules which I must presuppose as being in me prior to objects being given to me, and therefore as being *a priori*. They find expression in *a priori* concepts to which all objects of experience necessarily conform, and with which they must agree. [Kemp Smith translation (Macmillan and Co., London, 1950), pp. 22–23.]

This approach, Kant surmises, will provide the touchstone of a new method of thought: “that we can know *a priori* of things only what we ourselves put into them.” And this experiment, he concludes, succeeded as well as could be desired, promising to metaphysics, for the first time, “the secure path of a science” [ibid.].

Whether Kant's proofs, in the body of the *Critique of Pure Reason*, establish the success of this revolution in knowledge, as conclusively as did Galileo's proofs establish the success of the earlier revolution in astronomy, remains arguable, of course. But the second, like the first, was indeed conceived as a revolution essentially Copernican in nature.

A third self-conscious Copernican revolution has been proposed by John Dewey, and was specifically called that in the final chapter of his great work of 1929, *The Quest for Certainty*. Dewey argues, in short, that although Kant intended a Copernican revolution, his system does not in fact provide one. He failed, said Dewey, because in developing his so-called revolutionary account of knowledge, he remains in fact within the grip of classical, mistaken conceptions of what knowledge had to be like if it was to be knowledge at all. To know something, for Kant, was to know it certainly, absolutely. The question was not, for him, whether a priori knowledge was in fact possible—he never doubted that—but how in the world we *get* the a priori knowledge we obviously must have. To account for that knowledge he relocated the a priori contribution. It springs, said Kant, not from Divine imprint or external necessity, but from the structure of human intellect. But in his fundamental approach to knowledge, Dewey contends, Kant exhibits in a new guise the age-old error of supposing knowledge to consist of some wonderful correspondence between what was in the human head, and what was out of it—except that that correspondence was by him assured not by modeling the mind after the world, but by modeling the world after the mind. In either case the world comes out looking like a system of necessary truths, locked together by laws having universal and a priori certainty. Kant's work (on this interpretation) is more a revelation than a revolution—it reveals more clearly and more deeply than could that of his predecessors the purely *intellectual* mold into which everything was to be pressed. But all was pressed into that mold still; he simply explained, as no one could before, the alleged necessity of that mold. The knowledge system resulting from this Kantian method, says Dewey, is not really Copernican; it is truly Ptolemaic. As in Ptolemaic astronomy the celestial bodies revolve

about the Earth, in Kantian epistemology the objects of knowledge revolve about the knowing mind. Kant's alleged revolution, says Dewey, "consisted in making explicit what was implicit in the classic tradition." That tradition "had asserted that knowledge is determined by the objective constitution of the universe. But it did so only after it had first assumed that the universe is itself constituted after the pattern of reason. Philosophers first constructed a rational system of nature and then borrowed from it the features by which to characterize their knowledge of it. Kant, in effect, called attention to the borrowing; he insisted that credit for the borrowed material be assigned to human reason. . . ." But that underlying correspondence of reason and nature he never really questioned. In consequence, there is nothing hypothetical or conditional in Kant's framework of perception and conception. He took his categories, as Dewey points out, to need no testing, no experiment; they *must* work, uniformly and triumphantly. They are as inaccessible to the testings of a public science as are the hidden commitments of the Ptolemaic astronomers—only differently located.

Now, says Dewey, it is past time for a revolution in the theory of human knowledge that is genuinely Copernican. A great shift is indeed called for, not simply in the location of the framework for certainty, but in the nature of the standards to be applied to judgments themselves. What we know about the world must receive its warrant not from a priori principles (of any origin) but from a posteriori findings emerging from the process of experiment. Of course there will be ideas, hypotheses, directing experiment; but the function of these conceptual contributions is, for Dewey, as different from the function of Kantian a priori principles as is the Copernican from the Ptolemaic astronomy. For Dewey the directive idea is tentative, uncertain, to be appraised in view of the outcome of the experiments based upon it; concepts are not directive in the Kantian sense that they fix with apodictic certainty the forms within which all things can be known. Knowledge, for Dewey, does indeed flow from a partnership of the knower and the known; but for Kant that so-called partnership was in fact a silent subordination, in which the world might play its cards, but the knowing subject always had the deck stacked.

If these changes, Dewey concludes,

do not constitute, in the depth and scope of their significance, a reversal comparable to a Copernican revolution, I am at a loss to know where such a change can be found or what it would be like. The old center was mind knowing by means of an equipment of powers complete within itself, and merely exercised upon an antecedent external material equally complete in itself. The new center is indefinite interactions taking place within a course of nature which is not fixed and complete, but which is capable of direction to new and different results through the mediation of intentional operations. Neither self nor world, neither soul nor nature (in the sense of something isolated and finished in its isolation) is the center, any more than either earth or sun is the absolute center of a single universal and necessary frame of reference. There is a moving whole of interacting parts; a center emerges wherever there is effort to change them in a particular direction. [*The Quest for Certainty* (Minton, Balch and Co., N.Y., 1929), pp. 287–91.]

Which of these two revolutions, or alleged revolutions—that of Kant or that of Dewey—is more genuinely Copernican I leave for the reader to judge. Both, I think we will agree, are genuinely revolutionary if their author's accounts of the contexts in which they arise is substantially correct.

A Fourth Copernican Revolution

I conclude on a speculative note. Returning from theories about knowledge to theories about human society, I ask: Does there loom a possible or probable revolution, in the foreseeable future, which would be genuinely Copernican in character and sweep, and with respect to which philosophical reflection (and perhaps even guidance) is now in order? I think there is such a revolution before us, and I make bold here to sketch its outlines. If my speculations hit anywhere close to actual future events, there will be serious tasks for philosophers, professional or other, in the course of that revolution.

The revolution begun by Copernicus himself concerned the system of the world in its astronomical dimensions—what it was like, and what the constituents are of the movement and order that we perceive. Kant and Dewey proposed profound changes in our conceptions of knowledge—what it is like, and what the

constituents are of the knowing situation, the correct relations of knower and known, whatever the subject matter. The context to which I now move is that of human community and its planetary environment; it is a context far smaller than the astronomical, far greater than the epistemological. I suggest that we may be coming to a new conception of what that community is or ought to be, flowing from a revolutionized conception of its constituents. That revolution would chiefly concern neither the nature of the universe, nor the nature of knowledge, but rather the nature of ourselves, what we are and can be. And the problems it presents touch deeply upon the direction of our conduct.

The history of human kind, as a kind, has been, to this date, in a fundamental sense Ptolemaic. Here we are; there is the world. Men have taken their general task to be that of making a decent life for themselves within it, or at least getting along in it, however uncomfortable, as best they could until they got out of it. The external world is immensely perilous—moderately tractable on some dimensions but largely hostile—and men succeed in their aims to the extent they manage, through wit or endurance, to whittle out of nature the necessities and comforts of life. Human outlook has been Ptolemaic in this underlying assumption: whatever was to be done, it must be done *with* the world, to it, making it more manageable, more tolerable, more hospitable. We adapt ourselves to climates and terrains, to cities and institutions—but adaptation has consisted essentially in using what one part of the environment provides to protect ourselves (or advance ourselves) against the rest of it. Such efforts as there have been to deal with the human condition by altering the nature of humans rather than their conditions have been aimed at making our selves relatively impervious to the slings of fortune, or by causing ourselves to believe that interaction with the natural world is ultimately of no consequence. Either (it has been suggested) all that counts is within, and external suffering therefore trivial; or all that counts is in another world entirely, and external suffering therefore but of passing concern. Genuine human accomplishment, meanwhile, however little or great, has taken place with little regard either for stoical withdrawals, or supernaturalist escapes, in their several varieties. With many remarkable successes, and uncountable miserable failures, men have looked from themselves to the “natural”

world as though at a kind of thing as different from themselves, at root, as terrestrial clay was believed different from celestial crystal.

John Dewey's reinterpretation of knowledge was, to be sure, a powerful effort to bridge this gap. The revolution that looms, I submit, is the closing of it. Some philosophers—Democritus, and Epicurus, and Spinoza, as well as Dewey—long insisted that humans are essentially part of the natural world; but the fact remains that the conduct of men has not genuinely incorporated that conviction. "Human nature," it is tacitly and generally supposed, is one of the givens. We may develop or manipulate the potentialities it provides, with schoolrooms, or spankings, or psychological conditioning rational or irrational, but it is human clay in the end, not much better in the person of Bertrand Russell than in that of Parmenides. Now we enter a time in which that given is seriously to be questioned. Human beings, as a kind, will become the *subject* of experimentation and deliberately guided change, in a sense far deeper and more remarkable than as the individual recipients of torture, or training, or indoctrination. They will be the material out of which humans having quite different natures will be made; and the agents effecting change will be among the subjects in the process of being changed. The reflexivity of the situation is intellectually amusing; the possibilities for good and evil are so immense as to boggle the mind.

Copernican is the only word to catch the full spirit and impact of this change. Where previously human agency was directed chiefly toward what was "out there," to render it more tolerable or pleasing, the consequences of this revolution will be that the location of the satisfactory and the worthy will come to lie in the interaction of a world partly managed by human agents, with those agents having essential natures also under human control. As the movement of the spheres, after Copernicus, was seen to be a resultant of movements above and movements below, and knowledge, after Kant, was held to be a partnership of content without and capacities within; so now, the entire texture of what is human may come to be constituted by the warp of physical circumstance, and the woof of a deliberately self-changing humanity.

Events of great moment, impending in human history, often have early impact in limited spheres, or spheres tangential to their ultimate full thrust. These special manifestations—as with the early traces of the industrial revolution—are seen as troublesome, or perhaps hopeful, but are rarely appreciated as the foreshadowing of developments of which they are but the first vibrations. So, perhaps, is it here. It is first in the sphere of the fanciful—in Huxleyan dystopias and assorted works of science fiction—that the notions of controlled genetic mutation, and test-tube human breeding, and the like, are entertained. Quick on their tails come the horrors of actual genetic mutations flowing from accidental exposure to radioactivity, and from the ingestion of pharmaceuticals prepared with very different objectives. The prospect at first is quite frightening, and the possibilities of real and permanent benefit to mankind through deliberate self-change are very partially and very dimly glimpsed. Struck chiefly by the enormity of the dangers which open, as well as by the ignorance with which we face them, the understandable reaction on the part of many is to keep hands off—as though deliberate intervention in the evolution of the species were an act of profaneness, a "playing God" by men unworthy and incapable of the role.

But the course of history—barring some sudden nuclear or environmental catastrophe of now unimagined scope—is virtually certain to oblige humans to play that creative role. If we accept, as premise, that human population will continue to grow until meeting some horrendous "Malthusian check" or until rationally controlled and stabilized, we will either suffer unimaginable catastrophe, or we will sooner or later face up to the task of devising the instruments for that control and stabilization. Then, liking it or not, we will have to make decisions, some collective, some individual, regarding what we aim to do with humanity, with ourselves, and how we can tolerate doing it. Even the deliberate decision to take no controlling measures, when such measures are in fact in our power, is a decision which, if made, surely ought to be made with the greatest forethought. Perhaps we shall want to rely, for the future of the species, upon some sort of environmental lottery, or even upon a true lottery of our own devising. For my own part, it would seem that humanity deserves more from the use of its collective intelligence than sheer randomness.

In spheres in which previously randomness has always been taken for granted, how better it with deliberate control? No one can speak confidently now, of course. But so soon as this Copernican revolution is taken seriously, even as a distant but probable prospect, two philosophical tasks will confront us:

The first is that of deciding, or of developing criteria which may ultimately be used in deciding, what kinds of beings human beings are to be. In what directions are we to move in imposing rational control of human nature? No sooner do we say that some humans may reproduce and others not, than we must provide some principles upon which permission, or restriction, in this sphere, are to be grounded. The measures of control may be at first very limited, seeking only to eliminate those defects or negativities in the species upon which there is universal agreement. When that proves insufficient, as eventually it will, we shall face some much harder questions about what is to be encouraged, positively striven for, and at the expense of what. That is one serious practical task for philosophers—for whoever makes those decisions will be philosophers, whatever the source of their livelihood.

A second philosophical task, easier, I think, but not much easier, is that of devising the institutional machinery needed to reach those hard decisions. What kind of governance does a human community, undergoing a continuing process of deliberate self-change, need? What can it hope for? What trade-offs between ideal equalities and practical inequalities, between restraint in some spheres and liberty in others, are human beings prepared to accept or entertain? And what are the alternative modes of decision-making in this sphere, among which we might conceivably choose? If you find these questions painfully general, and hard even to begin to answer, I am on your side. I would observe, however, that hard as they are, we are almost certain to confront them eventually, and when we do, they will be even harder than they now seem, for two reasons.

First, it is probable that we won't really face up to these painful decisions until we absolutely must, and that means we will put off the needed judgments until it is too late to apply *any* rational judgments without imposing great suffering—moral agony, or physical pain, or both—upon many. It is likely—not certain, but

in view of recent history, very likely—that bold strategies upon critical matters will be collectively agreed upon only after the crisis is upon us. That will probably render them harder to devise, but impossible to postpone.

Second, the nature of the issues here is such that the framework within which the quest for direction is undertaken is itself in flux. That, I reemphasize, is the peculiarly reflexive, Copernican character of this revolution, if indeed it comes. The deliberate guidance of the evolution of the species, and the possible transformation of its members, is not simply another great step, or marvellous discovery. It will change every understanding of what human "steps" are or ought to be, and it may deeply alter our understanding of what "discovery" is for.

If I am anywhere near target in all of this speculation, it is right, I think, to view this contemplated revolution as Copernican in nature and sweep. About the future, of course, no knowledge is thoroughly reliable; we prognosticate with differing degrees of warrant. How much warrant there is for what has been suggested here I leave the reader to judge. But I note, in concluding, that if such a Copernican revolution does indeed lie before us, we are more likely to survive it, as a species, with success, if we begin to think about the trials it will present not after they are upon us, but now.

COMMENTARY

JOSEPH CROPSEY

THE CRUCIAL affirmation of Professor Cohen's stimulating paper consists in his characterization of Copernican revolution; and the decisive movement of the paper is toward extending the application of that conception of Copernican revolution beyond physics to the social life of man. The paper contains other things that are worthy of comment, but the crucial affirmation and the decisive movement raise such weighty questions that I

think it will be best to concentrate attention on those in these brief remarks.

From the outset, Professor Cohen takes note of the fact that all revolutions are changes but not all changes are revolutions, and he wishes to make clear what distinguishes revolutions from other changes. He argues that revolutions are more far-reaching than, for example, reforms. Among revolutions, there are a few that exceed the others in scope and reach, and these are Copernican revolutions. In order to grasp Professor Cohen's characterization of those overmastering Copernican revolutions, it is necessary to begin with revolution simply. Revolutions are changes that, in his words, "move us . . . from one theory to another, from one state of development to another . . . [and that moreover] overturn an established system, scientific or political, and replace it with another having an essentially different nature. . . ." Examples are the Industrial Revolution, the discovery of non-Euclidean geometry, and the Revolution of 1688, as well as the "Marxist revolution."

It would have been distracting from the main thrust of the paper if Professor Cohen had developed to precision the meaning of the notion of "essential difference in nature" as between two theories or states of development. For want of such precision, there will be disagreement over the judgment that the Marxist movement is revolutionary while the "populist" movement, as spoken for by the Students for a Democratic Society, is not. But rather than pursuing this, I wish to call attention to Professor Cohen's application of the concept of revolution in a single sense to theories and to states of development indiscriminately. The consequence of doing so cannot be made to appear until one reflects on Professor Cohen's characterization of Copernican revolution. I believe it is fair to say that the kernel of that characterization lies in these words, which are used to describe the discovery of Copernicus himself: "what other things seem to be, seem the way because we are in the condition that we are. . . ."

It is us remind ourselves of what exactly Copernicus was doing. He was explaining the apparent motion of the sun (among other bodies) and the apparent rest of the earthly observer by asserting the motion of the earthly observer and the motionlessness of the sun. To that extent, what he did was not different

from what had been done often and for ages before, namely, to discredit mere experience and to demonstrate that experience has a meaning or a basis that can be made manifest only through reason. At most, Copernicus showed that how the sun seems to move is explained or partly explained by a movement of our own. This is very far from showing that what the sun seems to be seems that way because we are in our actual condition.

That this is not a mere quibble is shown by Professor Cohen's subsequent description of the Deweyan philosophy as the product of a true Copernican revolution. Dewey is shown in corrective reaction against Kant. Kant, with his famous assertion of the unknowability of the things as they are in themselves, of course concurred in the view that we must therefore know them in the only other way available, namely, as they are for us. But in so knowing them, we do not simply "know" them; we contribute something of our own to the knowing and to the knowledge. The object of knowledge and we ourselves as the knowers have a constitution or character or nature that can be described as "fixed," and that is crucial to the contribution made by the knower to the knowledge. Dewey asserts that neither the object—the "course of nature"—nor the subject—man—is a certain something, but that all is flux, especially man who nevertheless appears to remain the measure of all things. At least I am not aware of any suggestion coming from Dewey that there is a baboon-conceived world-order and a self-changing baboon self-conception, and so on for mice and other beasts, and that these yield important alternatives to the human or rationally conceived world-order or course of nature. In Dewey's free-ranging displacement of universal centers, his mind fails to reach the one change that would provide a decisive test of his construction, namely, the change from a rational subject to a subrational one as *the* viewer of the whole. Instead, Dewey contents himself with proposals for human self-change that were in principle quite well worn by his time, having been made familiar, though more profoundly, through Rousseau's teaching of the vast alterability of human nature and the crucial importance thereto of education.

While I do wish to impugn Dewey's originality, I wish also and more emphatically to impugn his soundness. Before doing that, however, it is necessary to recur to Professor Cohen's point,

which agrees with Dewey's own self-appraisal, to the effect that the Deweyan formulation is a, or perhaps the, true Copernican revolution. I do not think so. Copernicus taught the world that a certain empirical fact cannot be understood on the empirical level. He did not maintain, and on the basis of his construction one cannot conclude, that after Copernicus understood what he understood, the world was changed an iota from what it had always been and must always be; nor that either the universe as such or man as such would undergo essential change through mutual influence. Only one change occurred, and that was in the content of men's minds. Not the object, not the subject, and not the relation between them is presented by Copernicus in a radically new light. I say this not with the intention of depreciating the great scientist but rather to praise his sobriety, which is in the highest tradition of science.

Dewey's teaching that all is in flux, and most of all man is in flux, suffers from the grave defect that a self-creator who cannot refer to a fixed criterion to govern the direction of his self-creation must necessarily be at best an anomaly and at worst a demented and unhappy thing of caprice. For reasons of his own, Dewey did not speak the language of existentialism but rather of "science"—experiment would show the way to man's self-creation and would somehow enable men to distinguish a desirable from an undesirable social outcome. If we learn anything at all from Copernicus, it is the inadequacy of mere observation or experiment to perform such tasks as Dewey, who was of course not a scientist, hoped the mind of man would be spared.

When Professor Cohen, in defining revolutions, speaks of essential difference between two *theories* or *states of development*, he does so in order to take account of the fact that some revolutions are in the realm of thought, as is the Copernican, and some in the realm of politics. If a Copernican revolution is one that locates in the observer something that explains what hitherto was attributed to the object, then one can understand how, for example, Hume's thought might deserve the name of Copernican-revolutionary. But by this criterion, how can any political change qualify to be so called? The theoretical formulation that lies behind a great political upheaval might qualify, but I do not see how the event itself can do so, according to the definition given.

This means that there is only one locus of Copernican revolution by Professor Cohen's definition, and that is in thought, in the mind; never in the phenomena or in the object. Certainly Hegel might explain the slave by reference to the master, and might define the nature of mastery through the nature of slavehood, but a political change that introduced or abolished slavery would not itself have the least influence on the definition of master and slave. Is it of any importance that this point be cleared up? Let us consider.

A legal system based on the publicly accepted belief that what seems to belong to the object is in fact to be explained by characteristics of the beholding subject would pose incalculable obstacles to the definition and then to the administration of justice. Is a crime the act of a criminal or the opinion of the witness? Or perhaps the passive act of the victim? Who are the real oppressed—the poor and exploited, as has always been taken for granted, or is it really a matter of perspective. The questions could be multiplied. It seems to me that the familiar distinction between theory and practice has survived for a reason that is more powerful than are the arguments for revolutionizing it. Professor Cohen has referred to the fact that, attached to the notion of revolution is the notion of the closure or completion of the turning about. I am put in mind also of the center or focus of a regular curve, some fixed point by reference to which the motion of a particle along the curve is alone intelligible. Speaking politically, the place of that fixed point is occupied by justice. Change and flux are endlessly enchanting. We must therefore be at pains to recall that change would have little meaning and less worth if there were not an unchanging and intelligible whole within which change can occur and be known.