they add the crucial point that preferences are subjective and relate to internal psychological states, and not merely to measurable "goods" (Hamlets perceive real costs in making decisions). By contrast with many social science assumptions they imply that individual decisions, meeting in transactions, are the basic unit for social analysis. Blau, Homans, and Boulding (but no transactional anthropologists) are credited as inspirations. Kuhn goes beyond most current theorists, however, in cogently distinguishing transactions from communications. It is highly significant that in the former *control* over goods (or "bads") is transferred, while in the latter information is transmitted but not necessarily control.

Kuhn's simple model of transactions starts from tight assumptions and is made complex by progressive relaxation of specific ones. It exemplifies well his procedure. Two selfish individuals, A and B, possess respectively the two divisible goods X and Y. If A would get more satisfaction from a unit of Y than he gets from a unit of X, and if B would get more satisfaction from a unit of X than he gets from a unit of Y, being selfish they will transact. This occurs when there is an overlap of their effective preferences, arrived at from independent weighing of their own costs and benefits—a zone where varying terms of transaction would benefit both parties, though to varying degrees. A is defined as having *interpersonal power* insofar as he can get B to do what he wants (that is, to transact) and *bargaining power* insofar as he can get good terms in the transaction. This precise definition of power in transactional terms exemplifies how Kuhn tries to systematize thinking in diverse disciplines and to promote standardized terminology. Relaxations of the model assumptions include assuming more parties (coalitions become possible) and the use of "bads" (threats, force, and so on, which imply that resulting transactions are not always positive-sum).

From discussing specific interpersonal power Kuhn proceeds to discuss *aggregate* (that is, generalized) *power*, deriving from it propositions about class and status in sociology and political science and about influences on perception in social psychology.

Organizations are the concern of the second half of the book, and again the treatment starts from a simple model of two persons agreeing to consciously coordinate actions, in a transaction of membership. A *complex organization* has more than two members, and here coordination cannot be subject to repetitive transactions. A complex organization is *formal* if the membership contract specifies kinds of instructions that the member binds himself to obey; by derivation come distinctions between *sponsors* (leaders), *staff*, and *members*, as in Weber's model of bureaucracy. Government and its specific properties are then analyzed as consequent on its being that formal organization that has a monopoly of force and may give all kinds of instructions to all persons in a territory. Organization theory and systems theory in political science provide the illustrative propositions that Kuhn derives deductively.

Informal organizations differ in not having DSE functions for the unit as a whole. Their reactions to external controls are similar to those that occur in ecosystems in not being directed purposively by the organization. Economic theory about market economies and stochastic sociology and demography are used as examples; examples from ecology show the dangers of a functionalism that ascribes purpose to an informal organization. Kuhn also discusses a third model type, *semiformal organizations*, where some, but not all, members feel that the organization has DSE functions as a unit. Although much of sociology and anthropology concerns such organizations, Kuhn examines only the family.

The work closes with discussions of how innovation and social change and development fit in the same logical system and of how concepts belonging to other disciplines could be derived deductively from the same assumptions.

It is a long, tightly argued book of over 500 pages. Definitions, models, and rationales follow each other in confusing succession. Technical problems include the author's having had to select only a few from the plethora of social science findings for his examples of deductions from assumptions; the work would have been intolerable if it had tried to be exhaustive. So too comparison between Kuhn's concepts and those of other theorists is deliberately excluded for reasons of space. This makes it hard to recognize what is new to Kuhn and what is repetition; it also weakens the work, for expectable attacks from, for example, Marxists are not forestalled by the derivation of identical substantive propositions about, say, surplus value or class consciousness from different assumptions.

The result, in short, is a frustrating work with obvious imperfections. It demands systematic reading from beginning to end, for system is its plea. But "the end"—the frontiers of social science research—is rarely reached, and the middle is hard going. The beginning, however, is a major synthesis, showing how transactional and communicational models together provide a basis for an integrated social science. If those models could be taught to beginning students of social science, the next generation of researchers would use the same code in all the disparate disciplines and would create the single deductive social science that existing specialist researchers resist so strongly, given their past experiences and cost-benefit structures.

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Man and Machine

Zen and the Art of Motorcycle Maintenance. An Inquiry into Values. ROBERT M. PIRSIG. Morrow, New York, 1974. 412 pp. $7.95.

Technology, one of the defining characteristics of mankind, has been a part of every human community that ever existed, no matter how primitive, and the influence of science has shaped the intellectual outlook and the style of life in Western society since the Renaissance. Nevertheless, it was not until the 20th century that the significance of these twin forces began to be studied in a systematic way, and we have yet to forge the intellectual and methodological tools necessary for the full comprehension of scientific and technical activity within a wider social and intellectual matrix. The "experts" on these matters—the sociologists, historians, and philosophers who write on the social implications of technology and science as their specialty, and the senior scientists and engineers who turn to the subject after having distinguished themselves in professional careers—have missed the mark. They have yet to make contributions commensurate with the complexity and range of their subject. The appearance

of *Zen and the Art of Motorcycle Maintenance*, along with Studs Terkel's *Working* (Pantheon, 1974), has convinced me that some of the most original and imaginative books on technology and society are being written by authors who do not claim a professional expertise in the field. I believe that *Zen and the Art of Motorcycle Maintenance*, with its highly personal and yet analytical approach to technology and rationality, might open new paths for those specialists who see the scope of the problem but have yet to find creative ways in which to pursue its solution.

The author's note warning his reader that the book offers little factual information on either orthodox Zen Buddhist practice or actual motorcycle maintenance should quiet the fears of those who suspect this to be yet another counter-culture attack on science and technology. It was not written by a leather-jacketed motorcyclist who obtained his knowledge of Eastern religion from a hasty reading of an Alan Watts paperback. Pirsig, a 46-year-old technical writer, is employed writing computer instruction manuals. He studied chemistry and philosophy at the University of Minnesota (B.A. 1950), having entered at age 14 with the intention of becoming a molecular biologist. After studying Oriental philosophy at the Benares Hindu University he taught English composition and rhetoric at the State University of Montana and did graduate work in ancient philosophy at the University of Chicago.

These facts are the structural elements upon which Pirsig builds his three-level autobiographical account of motorcycle travel and intellectual exploration. Taken at its simplest level, this is a story of a father and his 11-year-old son traveling by motorcycle, camping along back roads, from Minnesota to California. It extols the motorcycle as a vehicle that, by contrast with the automobile with its cushioned seat before the rectangular "TV screen" of the windshield, thrusts the rider into close contact with the physical environment through which he speeds. The book's description of natural scenes and the local people encountered in small-town restaurants and motels would earn its author recognition as a sensitive, if not original, writer of travel narrative.

Progressing to the next level of complexity we learn that the father has suffered a serious mental breakdown and that his son is showing early symptoms of psychotic illness. As they travel to the Pacific Coast, father and son are pursued by a ghost, Phaedrus, the remnants of the father's earlier personality. Phaedrus had been:

> Destroyed by order of the court, enforced by the transmission of high-voltage alternating current through the lobes of his brain . . . on twenty-eight consecutive occasions. . . . A whole personality had been liquidated without a trace in a technologically faultless act that has defined our relationship ever since. I have never met him. Never will. . . .
>
> And yet strange wisps of his memory suddenly match and fit this road and desert bluffs and white-hot sand all around us and there is a bizarre concurrence and then I know he has seen all of this [p. 91].

Intense psychological analysis supersedes travel narrative and in turn reveals the metaphysical problem lying at the core of the book. How can the discordant worlds of the rational and the irrational, of logic and emotion, be reconciled? Phaedrus, a brilliant, abrasive man with a restless intellect, was exploring this problem when he lost his sanity. The narrator, who emerged from the technological act that annihilated Phaedrus, recalls the general lines along which Phaedrus had been thinking and gropes to find his own answer. The motorcycle, as technological reality and symbol of the rational order, figures largely in Pirsig's answer as it does in binding together travel narrative, psychological analysis, and metaphysical inquiry. And this is as it should be, because, according to the author,

> The Buddha, the Godhead, resides quite as comfortably in . . . the gears of a cycle transmission as he does at the top of a mountain or in the petals of a flower [p. 26].

The unified world view implied by this quotation is not in keeping with the Western intellectual tradition. Nor does it fit comfortably into the Eastern philosophical-religious outlook. True, the German philosopher Eugen Herrigel had written about sport and Zen Buddhism in *Zen in the Art of Archery* (Pantheon, 1953), but shooting an arrow at a target involves a traditional technology not to be compared with lubricating and tuning a motorcycle engine, welding a broken chain guard, or tracing a short circuit in the cycle's electrical system. Is it indeed possible to experience an Epiphany amidst the greasy clutter of a mechanic's workbench? Is the Godhead to be found among socket wrenches, spark plugs, speedometer cable, and handlebar shims? Yes, says Pirsig, but first you must make a critical attack on some of the central ideas of Western culture.

As an undergraduate Phaedrus discovered that science was not the source of final truths; he learned that it was but one of many branches of philosophy. Like any other intellectual venture science existed as a "ghost," an idea, in the minds of the men who first conceived it and then perpetuated it.

Science and rational inquiry in general gained status in the West from our acceptance of the bifurcated world created by subject-object dualism. This dualism made objective knowledge, at most, superior to subjective knowledge and, at least, its copartner in an antagonistic relationship constantly generating paired dichotomies: mind and matter, feeling and reason, art and science, life and technology. Phaedrus's battle against subject-object dualism began in Bozeman, Montana, where he was searching for new ways to teach his undergraduates the meaning of good writing. It ended in Chicago when he pursued dualism to the very edge of Western thought, closely reading Aristotle and Plato, and to the limits of sane inquiry, lying in a pool of his urine with fingers blistered by burning cigarettes about to be committed to a mental hospital.

Phaedrus-Pirsig first transformed subject-object dualism into a trinity by the inclusion of value judgments associated with the words "excellence," "worth," and "goodness." These he called Quality. A subsequent transformation reduced the original duality to a secondary role and placed Quality alone at the top. Quality became "the *parent*, the *source* of all subjects and objects" (p. 247). It is "so simple, immediate and direct" (p. 250) that it defies definition and yet it remains "the continuing stimulus which our environment puts upon us to create the world in which we live" (p. 251). With the supremacy of Quality Pirsig resolved the inconsistencies he found in Western philosophy and aligned himself with the great minds of the Orient, especially Lao Tzu.

What is the place of Quality, Tao, or Zen in 20th-century industrial civilization? A question of this sort is typical of the queries encountered in the bifurcated Western world, where the mechanic has been carefully set

apart from the machine. Western man has been taught to divide reality into the subjective and the objective and then to exclude Quality from the objective knowledge upon which science and technology are based. Consequently, he cultivates a value-free, uninvolved attitude toward machines. Technology is something "out there" that he manipulates for profit or pleasure without caring to understand.

Pirsig's commentary on these matters reveals the holistic nature of his philosophical approach:

> The real cycle you're working on is a cycle called yourself. The machine that appears to be "out there" and the person that appears to be "in here" are not two separate things. They grow towards Quality or fall away from Quality together [p. 325].

This is similar to the thought Pirsig found printed on an instruction sheet accompanying a foreign-made bicycle, "Assembly of Japanese bicycle requires great peace of mind" (p. 164). To confront successfully the assembly of a bicycle, the maintenance of a motorcycle, or the care and understanding of any other manifestation of modern technology requires a series of acts of value judgment accompanied by a mental predisposition to view subject and object, mechanic and mechanism, as a unity. Pirsig hopes that the introduction of Quality into technology will carry us back into a "craftsmanlike self-involved reality" (p. 282) where the mechanic *cares* about his work.

Some of the issues raised here have been discussed in a similar vein elsewhere in philosophical literature, but never with such intensity and never with such close attention paid to the details of the machine. What academic philosopher would claim that a motorcycle is primarily a mental phenomenon and that the study of its maintenance "is really a miniature study of the art of rationality itself" (p. 98), or could write a serious philosophical discourse about Aristotle, Plato, Kant, and Hume in terms of Harley-Davidson and BMW?

Pirsig has done much in helping us to understand better the nature of science and technology and to appreciate machines and the men who work closely with them. He is at his best when dealing with the relationship between one man and one machine. Unfortunately, he does not systematically extend his analysis from personal mechanical maintenance to the manufacture of mass-produced items on an assembly line by large numbers of workers.

In writing his book *Working* Studs Terkel interviewed a wide variety of workers and allowed them to speak for themselves on the meaning of work. One of the constant complaints of the industrial worker was that he was unable to identify with the product he built and that slovenly workmanship went unnoticed. What does Pirsig's Quality mean in a factory situation where it has been distorted into quality control which is concerned with maintaining the barest minimum standards, not the highest ones? Why should the worker show care in his daily work routine when his job has been designed to rule out caring? In the words of a spot welder at an automotive assembly plant:

> Proud of my work? How can I feel pride in a job where I call a foreman's attention to a mistake, a bad piece of equipment, and he'll ignore it. Pretty soon you get the idea they don't care. You keep doing this and finally you're titled a troublemaker. So you just go about your work [*Working*, p. 162].

Between Terkel's record of job dissatisfaction and Pirsig's philosophical insights into the man-machine relationship lies an important, but relatively unexplored, area of industrial civilization. *Zen and the Art of Motorcycle Maintenance* might well serve as a preliminary guide for those who in charting this territory will aid man's attempt to redirect technology toward the realization of broadly based social goals.

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