

**SOCIOLOGY: A COPERNICAN SOCIAL SCIENCE REVOLUTION  
AND ITS IMPLICATIONS FOR SCIENCE IN CULTURE**

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The conception of scientific and technological culture at the center of our interests here seems initially to grow out of a traditional scientific worldview. One could even say more narrowly but more pointedly that it reflects a traditional ideology of science. This worldview – this ideology – is grounded in the preeminence of the physical and natural sciences, and the experiences and achievements of physicists, chemists, and biologists. But at the same time, the symposium is anchored “in the heart of the current debate and discussions over new ways of conceiving the development of scientific and technological culture.” This opens the door for sociology (and anthropology), as well as for the sociology of science and technology. My claim is that the issues and problems around which this symposium has been organized cannot rightly be apprehended without a sociological imagination.

The fashionable term “technoscience” is one of the fruits of the interdisciplinary social studies of science and technology movement. That conception of the interdependence of science and technology will stand in the wings and perhaps hover about me while I concentrate on what is still recognizable as a distinct discourse, science. But what I say must be understood to apply to technology and to technoscience.

My main objective is to bring sociology into our debates and discussions as a discovering science. But I do not want the term “discovering science” to be understood as making sociology a slave to or immature offspring of the physical and natural sciences. I use the words “discovery” and “science” nonetheless, but stress that in my usage they carry reconstructed meanings as a consequence of research in the new sociology of science, that is, the sociology of science that has

emerged over the past twenty-five years. I want, then, to alert you to an invisible revolution wrought by sociological discoveries and the new sociology of science they have spawned.

Sociology has a bad reputation. Much of what it has stood for has indeed been, as its critics claim, needlessly obtuse and empty. Even sociologists have wondered at times if they were saying anything. But there is a core of significant worldview-shifting discoveries at the core of sociology. These discoveries are associated with what I call the high tradition. The low tradition is represented by the motley collection of titles in the sociology sections of shopping mall bookstores, images of sociology as a “soft science,” a form of socialism or social work, and a pretentious inquiry that disguises common sense and the obvious in the jargon-infested trappings of a social science. Even the idea that sociology is a “hard science,” to the extent that it imports a sexist and scientistic view of the field from the physical sciences, and stresses formal and methodological concerns over substantive social ones, is part of the low tradition. It is this low tradition that grounds the 11th commandment authored by the conservative political commentator George Will – “Thou shalt not commit sociology.”

The high tradition in sociology traces its roots to the revolutionary discoveries about self, society, and culture made between 1840 and 1920 by Karl Marx, Max Weber, Emile Durkheim, George Herbert Mead, and others. The most important discoveries they made that bear on our understanding of the nature of science are that selves and minds are social structures, and that all forms of knowledge and belief are social and cultural constructions. This period of discovery reflects a general cultural climate which can be characterized in terms of the rejection of transcendence. It will be helpful, incidentally, in thinking about sociological discoveries, to learn from sociologists of science that discovery is not a simple matter of finding something new in the world. It is actually a rather complex and inventive social process that involves, among other factors, techniques of communication, negotiation and conflict, and crystallization of the discovery over time.

The discoverers of society carried out a Copernican revolution that transformed our understanding of the social world. They identified the group, the collectivity,

or culture as the center of the human universe. Copernicus helped move the sun to the center of our solar system and the earth to a peripheral position. The sociologists helped move the group to the center of the human universe and the individual to the periphery. This achievement does not politically subordinate the individual to the group. Rather, it reveals how varieties of individual growth and development, and the formation of different types of persons, are dependent on forms of social organization and culture. Through its influence on the sociology of science, the Copernican sociological revolution has also had an impact on our understanding of science and of natural and physical realities. We are, in fact, in the midst of a second sociological revolution that is changing our conception of the nature of knowledge. The seeds of this revolution were planted during the earlier revolution, but it is only recently that sociologists have developed the appropriate tools, concepts, and orientations to pursue Marx's ideas on the social roots of knowledge, Durkheim's conjectures on the social nature of religion, logical concepts, and objectivity, and Spengler's insights on mathematics and culture.

All of the ingredients of the invisible revolution I have been sketching here appear in the following excerpt from Marx's *Economic and Philosophic Manuscripts of 1844*:

Even when I carry out scientific work, etc., an activity which I can seldom conduct in direct association with others – I perform a social, because human, act. It is not only the material of my activity – like the language itself which the thinker uses – which is given to me as a social product. My own existence is a social activity.

Here, then, we have in the space of a few lines the ideas that the self, the mind, and science are social constructions. This perspective achieves its classical sociological form in the closing pages of Emile Durkheim's *The Elementary Forms of the Religious Life*, where Durkheim introduces a non-obvious sociology of logical concepts. In the wake of contributing to the discovery of what the gods and religions are, Durkheim's sociology of logic completes one of the earliest signs of the modern rejection of transcendence. The further articulation of this rejection was accomplished notably in Spengler's analysis of mathematics as a cultural phenomenon, and George Herbert Mead's theories of self and mind. Spengler's analysis would go virtually unnoticed until the emergence of the new sociology of

science and in particular the development of the sociology of mathematics in the works of David Bloor, myself, and Randall Collins. In 1939, C. Wright Mills pointed out that Mead's sociology of mind had been ignored to the detriment of the sociology of knowledge and science. Some fifty years later, Randall Collins could still make this same observation about Mead's work, and it is only in the last few years that Collins and I have begun to resurrect Mead's theories to help fashion a sociological theory of mind and thinking.

Another important figure in the invisible revolution that is my theme is Friedrich Nietzsche. His criticisms of religion and of philosophy were major contributions to the rejection of transcendence. He warned us to be on guard against "the myth of a 'pure, will-less, painless, timeless knower'; let us beware," he continued, "of the tentacles of such contradictory notions as 'pure reason,' 'absolute knowledge,' 'absolute intelligence.' All these concepts presuppose an eye such as no living being can imagine, an eye required to have no direction, to abrogate its active and interpretative powers – precisely those powers that alone make of seeing, seeing something. All seeing is essentially perspective, and so is all knowing. The more emotions we allow to speak in a given matter, the more different eyes we can put on in order to view a given spectacle, the more complete will be our conception of it, the greater our 'objectivity.'" Here is the starting point for the sociology of objectivity I proposed in 1974 and later developed further while David Bloor was also independently developing a sociology of objectivity. Meanwhile, Randall Collins has been working within the framework of this invisible revolution to fashion a causal sociology of philosophies that is generalizable to intellectuals (including scientists), and it is worth summarizing some of the main points of his theory (even though they will appear somewhat cryptic out of context): (1) major intellectual work tends to be concentrated in time, space, and social connections; (1a) intellectual work is almost always concentrated in the same time period as other work of a similar degree of innovativeness and scope; (1b) notable intellectual activity typically has been concentrated, at any given time, in a small number of places; (1c) the most notable philosophers are not organizational isolates, but members of chains of teachers and students who are themselves known philosophers, and/or of circles of contemporary intellectuals; (2) the number of intellectually active schools of thought is almost always on the order of three to six (law of small numbers); (3) schools of thought rise and fall due to the

fortunes of their organizational bases; 4) periods of greatest intellectual creativity are periods of major organizational transition; (5) factional loyalists produce a steadily lengthening corpus of scholastic materials; (6) conflict among rival positions produces a trend toward abstraction and self-conscious reflection on intellectual objects; (7) new positions are produced by negation of preexisting positions along the lines of greatest organizational rivalry.

The intellectual resources I have identified are not instances of nostalgia for the classical theorists, but part of the contemporary fund of cultural capital that has helped us to fashion such counter-intuitive notions as the sociology of god, truth, nature, reality, objectivity, and logic. There is a masculine Euro-American bias in the selection of certain men to represent this invisible revolution, but it is a revolution generated and sustained by working class men and women (as E.P. Thompson helped to document), and by sociological theorists from Harriet Martineau to W.E.B. DuBois and Dorothy Smith.

What does science look like, then, from the perspective of the invisible sociological revolution? I want to sketch a portrait of science as a social construction. I will do this with specific reference to mathematics, a subject that I devoted most of my research efforts to in the 1980s, sometimes in collaboration with Randall Collins.

Mathematical knowledge is not simply, to borrow some phrases from the anthropologist Clifford Geertz, a “parade of syntactic variations,” a set of “structural transformations,” or “concatenations of pure form.” The more we immerse ourselves ethnographically in math worlds, the more we are impressed by the way mathematical forms or objects increasingly come into view as sensibilities, collective formations, and worldviews. The foundations of mathematics are not located in logic or systems of axioms but rather in forms of life. Mathematical forms and objects embody math worlds. They contain – indeed they are – the social histories of their construction. They are produced in and by math worlds. It is, in the end, math worlds, not individual mathematicians, that manufacture mathematics.

This idea has not gone unnoticed by mathematicians and philosophers of mathematics. Their sociological understanding is inevitably, however, limited. Take, for example, Philip Kitcher’s views on the nature of mathematical

knowledge. Kitcher seems to understand that knowledge has to be explained in terms of communities of knowers, and that stories about knowledge can be told in ways that reveal how knowledge is acquired, transmitted, and extended. This is the only story Kitcher can tell; but he is intent on making his story confirm rationality and well-founded reasoning in mathematics.

Rationality and well-founded reasoning (and, more generally, cognition) cannot be separated from social action and culture. Where it appears that we have effected such a separation it will turn out that we have simply isolated mathematical work as a sociocultural system, and told a sociologically impoverished story about how that system works. The extent to which mathematics is an autonomous social system (institutionally speaking) will vary from time to time and place to place, and so then will the extent to which an empiricist epistemology (e.g., Kitcher) can construct a rational explanation for mathematics. But “rational” refers to the rules governing a relatively well-organized social activity. “Rational” is synonymous with “social” and “cultural” as an explanatory account. Explaining the content of mathematics is not a matter of constructing a simple causal link between a mathematical object such as a theorem and a social structure. Jean Dieudonné’s challenge exposes a fundamental misunderstanding of sociological claims about science and mathematics:

Celui qui m’expliquera pourquoi le milieu social des petites cours allemandes du XVIII<sup>e</sup> siècle où vivait Gauss devait inévitablement le conduire à s’occuper de la construction du polygone régulier à 17 côtés, eh bien, je lui donnerai une médaille ou chocolat.

The sociological problem is first to look to both “external” contexts etc. and “internal” networks etc. Dieudonné’s error is to imagine that only “external” milieux hold social influences. Second, the sociological task is to unpack the social histories and social worlds embodied in objects such as theorems. Mathematical objects must be treated as things that are produced by, manufactured by, social beings through social means in social settings. There is no reason why an object such as a theorem should be treated any differently than a sculpture, a teapot, or a skyscraper. Only alienated and alienating social worlds could give rise to the idea that mathematical objects are independent, free-standing creations, and that the

essence of mathematics is realized in technical talk. Notations and symbols are tools, materials, and in general resources that are socially constructed around social interests and oriented to social goals. They take their meaning from the history of their construction and usage, the ways they are used in the present, the consequences of their usage inside and outside of mathematics, and the network of ideas they are part of. Mathematics, science, and knowledge in general are crucial resources in all societies. Systems of knowledge therefore tend to develop and change in ways that serve the interests of the most powerful groups in society. Once societies become stratified, the nature and transmission of knowledge begins to reflect social inequalities. And once knowledge professions emerge, professional boundaries tend to shield practitioners from the realities of their broader social roles even while they define a realm of systemically (institutionally) autonomous work. Science and math curricula in such contexts are certainly influenced by professional interests and goals, but they are also conditioned by the social functions of educational systems in stratified societies.

Science worlds are social worlds, and we must ask what kinds of social worlds they are. How do they fit into the larger cultural scheme of things? Whose interests do they serve? What kinds of human beings inhabit science worlds? What sorts of values do science worlds create and sustain? Scientific change in and out of the classroom must always be examined closely in order to understand its relationship to wider social changes. It follows from all I have said that reforms and changes in general cannot be effectively carried out in isolation from broader issues of power, social structure, and values. If, on the other hand, we adopt conventional scientific tools and ways of working to help solve social, personal, and environmental problems we will fall short of our goals. It is therefore unreasonable to suppose that social reformers and revolutionaries could *eliminate* science from society, and equally unreasonable to suppose that science reformers and revolutionaries could *force* science as we know it today into some "alternative" shape independently of broader social and cultural changes.

Platonism, apriorism, and foundationalism (along with God) are dead. But the protective, awe-inspired, worshipful orientation to science survives. This is understandable, readily as a vestigial homage to the culture and conversation of the West (as in the works of Richard Rorty, the John Wayne epistemologist, for

example), less readily as a vestigial homage to the God of the West (as Spengler realized). One can see historically, from Mannheim and Scheler to Donald Campbell, that the dialogue between the sociology of knowledge and epistemology has flirted with a radical sociological reconstruction of our understanding of science and culture. It is futile to try to construct an epistemologically relevant sociology that falls short of a full-fledged world view analysis, critique, and reconstruction of science and culture.

It appears that until we fully extricate ourselves from the hold that Plato has had on us, we will never be able to fully appreciate sociology and anthropology as the revolutionary sciences (or forms of life) they are. When we make this move, we will find ourselves confronted with the end of a certain way of doing inquiry, and finally with the end of a certain way of living. The death of God presages the death of epistemology and of philosophy. For the moment, sociology and anthropology stand ready to take their place as the most important cultural productions of industrial civilization. They may go the way of philosophy eventually, but attacks that promise their premature demise are attacks that undermine our future as a culture capable of meeting the challenges of the global, multicultural society.

Kafka's assertion in *The Trial*, "Logic is doubtless unshakeable, but it cannot withstand a man who wants to go on living" would find ready endorsement from Dostoevsky, Nietzsche, and others. These thinkers held such views not because they were "relativists" or under-appreciated the value of inquiry but rather because they appreciated the dialectical complexities of social structures and cultures. They were critics of the "Cult of Science" and that cult's intense "faith in science." In order to appreciate this, we must recognize that when we talk about science, truth, logic, and related ideas, we are always talking about social relations. This way of seeing sensitizes us to the progressive and regressive aspects and potentials of words, concepts, and ideas that as social relations can embody inequalities, destroy environments, inhibit individual growth and development and undermine inquiry. The next time someone wants to ask an expert about the nature of science or God, he/she had better turn to a sociologist or anthropologist instead of a physicist, astronomer, chemist, or biologist if he/she wants to escape Plato's clutches and learn something.

