# The Social Construction of Scientific Facts and its Implications for Social-Scientific Inquiry

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## The Constructive Perspective

### Introduction

The understanding of scientific knowledge and objectivity has sociologically undergone considerable changes in recent decades moving from the normative functionalist model associated with Merton, which tends to idealize the norms of science 'and affirm modern science as a progressive, well-functioning system' (Revisto 1988:213), through Kuhn's post empiricist model of natural science (Van Niekerk 1995:182) in which the consensus theory of true displaces the correspondence theory (that is, scientific theory is true if it allows predictable control and manipulation of the natural world (Gorski 1990) to seeing nature as constructed by the social process of science (e.g. Latour 1987). These changes amount to a conceptual revolution in the sociological study of science. They constitute what is fashionably referred to as the constructivist perspective in the sociology of science (Collins 1980). Kuhn's postempiricist model of science and the constructivist perspective overlap in important respects in that both are concerned with the observation of the empirical practise of scientists, rather than with a prior normative judgement about them. In a way the two comprise the 'new sociology of science' (Barnes, et al 1982; Vancraeynest, et al 1988). Theoretical and empirical content of the constructivist perspective is constituted by contributions from sociology of knowledge (e.g Bloor 1976), history of science (e.g Galison, 1983; Toulmin 1972) and philosophy of science (e.g Baigrie 1988; Fuller 1993; Boring 1952).

A particularly notable contribution to the constructivist perspective comprises ethnographic researches carried out in natural science laboratories. The focus of these ethnographies is the day-to-day practice of science in contradiction to earlier studies which focussed on the normative structure of science (e.g. Cole and Cole 1972). Woolgar has observed that constructivist 'studies indicate a move towards a sociology of science and away from a mere sociology of scientists' (Woolgar 1982:481). Similarly, Baigrie (1988) has argued that the logical canons of explanation as in the writings of Popper, for example have been abandoned in favour of sociology ones, as is evident in the way the language of epistemology has changed from 'theory' to socially loaded terms like 'paradigm' and 'research tradition'.

The general conclusion, deriving from researches conducted within the frame of reference of constructivism, is that scientific knowledge is socially constructed. Scientists assign meanings to objects in their environment in the same fashion that non-scientists do. Objects in the scientific world do not possess intrinsic meanings, and scientific knowledge is not an objective description of the material world as traditional accounts of science assume. The actual nature of the material world is ambiguous for scientists and non-scientists alike. Hence, scientists are compelled to attribute meaning to the scientific world, to socially construct it. This paper attempts to characterize the social constructivist perspective's account of scientific practice and highlight some of its implications for socio-scientific enquiry.

### Scientific Practice

Research by Latour and Woolgar (1986) is a notable instance of ethnographic study of social

processes of scientific activity in a laboratory. The use of terms such as 'transformation' suggests that their observation of laboratory activity was measurably informed by systems thinking. Latour and Woolgar used the concept of transformation to describe the social construction of scientific facts. In a general sense, transformation is the process by which literary inscriptions (data) come to be regarded as scientific facts. A literary inscription, or set of inscriptions does not become a scientific fact in one step. For an inscription to become a scientific fact, it undergoes several specific transformations during the fact construction process. Latour and Woolgar describe how the results of a number of bioassays (literary inscriptions) were transformed into an accepted description of the chemical structure of a particular hormone compound (a scientific fact). The results of the bioassays underwent several specific transformations before the accepted description of the hormone compound emerged. Thus, the transformations included coding the results of the numerous bioassays placing them in a computer, and statistically analyzing them. Each of these steps was a specific transformation designed to push a set of inscriptions towards factuality. Initially, all possible literary inscriptions have an equal probability of being transformed into a scientific fact. 'So the objective of the game is to carry out all possible manoeuvres which might force the scientists (or colleagues) to admit that alternative statements are not equally plausible' (Latour and Woolgar 1986:24).

Transformations (i.e. practical operations) change the form and content of literary inscriptions as the research process moves into report and paper writing. Thus the details surrounding the production of an inscription seldom appear in research reports or papers. This is instanced here by Latour's ventures in the laboratory - that is - when he made several mistakes during the performance of his assigned research duties. In one case he was supposed to treat a large number of experimental cultures with a specific chemical compound. He found the task menial and boring and he sometimes forgot whether he had treated some of the cultures. This necessitated his starting all over again. In such a state of affairs some of the cultures may have received much more of the chemical treatment than was called for by the experiment. When the observer (Latour) reported his mistakes, the scientists in the laboratory made light of his errors and no mention of these mistakes ever appeared in subsequent research reports and papers.

In his systematic approach to science, which focuses on revolutionary succession of time-bound scientific systems, Kuhn (1970) posits that the influence of social factors on the process of scientific inquiry is understood as contingent. Writers on sociology of scientific knowledge on the other hand, postulate the thesis that the influence of social factors on scientific inquiry is inevitable (see Twenhofel 1990). A biology laboratory based support for sociologists of science's thesis is provided by Scott (1991). In *Give Me a Laboratory and I will Raise the World*, Latour (1982), basing his arguments on the work done with anthrax by Louis Pasteur in nineteenth-century France, asserts that scientific laboratories are irreplaceable sources of political strength and new sources of power. However, as a way of refuting Latour's argument - thereby lending credence to the sociological account of scientific knowledge according to which the influence of social factors on scientific inquiry is inevitable - Scott (1991) presents a case study of the contemporary Australian Animal Health Laboratory, which, though using the same tactics as Pasteur used failed to attract supporters in its research on exotic animal disease viruses. Scott then concludes that Latour ignores the complexities of the social forces operating in any particular context, especially political forces, that may encourage or undermine the potential power of laboratories. Similarly, Fuller (1993) argues that the partisan interests of scientists and their patrons

ultimately are inseparable from scientific knowledge and its technological consequences. In line with the sociology of scientific knowledge's orientation, Latour and Woolgar argue that social factors determine a scientist's ability to effect the transformation of inscriptions into facts. The social factors include the credibility of the scientist and the circumstances in which the scientist works (Latour and Woolgar 1986).

**Credibility and Transformation**

The credibility of a scientist refers to his or her ability to persuade others of the factuality of his or her findings. All transformations occur in an interactional context involving negotiation among individual scientists. An inscription stabilizes as a fact when a network of scientists is persuaded of its soundness. A case in point is Rothman (1990). Rothman discusses the problem of pathological or wishful science - where overly enthusiastic scientists completely fool themselves without intending to - using the example of the recent controversy concerning the alleged 1989 discovery of 'cold fusion' by chemists at the University of Utah in the United States of America. Immediately before its publication in *Nature* (24 March 1989), the University called a press conference to announce the results of their (chemist's) experiments. When *Nature* requested and failed to receive additional details on the experiment, the scientists withdrew the paper from publication. This action prompted a stampede of news conferences and attemps by dozens of laboratories to confirm or deny the reality of the cold fusion claim. Finally, the Harwell laboratory in Great Britain, working in full co-operation with one of the Utah scientists, dealt the deathblow to the controversy by announcing that it could not successfully replicate the cold fusion experiment (Rothman 1990). Referring to the scientists who allegedly discovered cold fusion, D'Andrade (while discussing objectivity in ethnographic anthropology) aptly points out that 'What Pons and Fleischman said about cold fusion was objective enough, but unfortunately what they described seems to be unreplicable' (D'Andrade 1995:400).

The paper was withdrawn from publication because its authors realized that in terms of paradigm-specific conventions, their scientific knowledge-claim of cold fusion could not be exempted from the rule that individual scientists cannot establish matters of fact until their conjectures are demonstrated experimentally and withstand the scientific community's effort to refute them. (Popper 1967; Kuhn 1970).

Credibility is a function of past investments in the scientist, reputation in the field, institutional affiliations, funding support for the research, the personality of the scientist, publication outlets, and the style in which the findings are presented. Accordingly, Latour and Woolgar (1986) describe how credibility operated to affect transformation. Two groups of scientists utilizing different approaches were competing with each other in order to be the first to isolate TRF, a hormone compound. One group, headed by Guilleman, managed to persuade the scientific community that its chemical analysis approach was superior to the physiological approach of Harris and McCann. Latour and Woolgar attribute Guillemin's success to his ability to recruit good scientists to his research team and attract extensive funding for his approach. Thus, in this case, reputation and funding support were used in the push of one team's work towards the truth and in the process, undermined the work of a challenger.

The importance of credibility (or the lack thereof) in transforming inscriptions into scientific facts is exemplified further by the excerpt below.

> K and L were counting samples on the beta. K is fifteen years older than L.
>
> **L:** Look at these figures, it's not bad.
>
> **K:** Well, believe my experience, when it's not much above 100, it's not good, it's noise.

L: The noise is pretty consistent though.
K: It does not change much, but with this noise you can't convince people... I mean good people (Latour and Woolgar 1986:200)

In this particular case, L, probably because of the age difference between him and K, did not possess enough credibility to persuade K that the inscriptions obtained from the beta counter were stable enough to be moved along in the fact construction process. Consequently, no transformation occurred. What might have been considered a scientific fact was dismissed as noise.

In their ethnographic study of a molecular biology laboratory, Aman and Knorr-Cetina (1989) examined, among other things, the nature of scientific thinking (including thinking aloud) and patterns of talk. They observed several tools (i.e. patterns of talk), interactionally accomplished inference mechanisms including thinking aloud. They analyzed the tools in detail in terms of dialogues and the episodic quality of argumentative talk. The thrust of Aman and Knorr-Cetina's argument is that patterns of talk are a public, socially organized activity, not restricted to individual minds. What amounts to an example of a pattern of talk in this connection is provided by Myers (1991). Myers gives an analysis of linguistic features associated with politeness, focusing on collaboration in scientific groups. He points out that during disagreements, the choices of pronouns or impersonal constructions and the toning down of the force of an assertion are strategies used to avoid threatening a collaborator. The attitude taken in these situations often resembles that taken when a person is in doubt or is uncertain. Thus, it is hard to differentiate between holding back criticism and uncertainty about evidence or reasoning. Clearly, these linguistic features are part and parcel of the social process of transforming inscriptions into scientific facts.

## Circumstances and Transformation

Circumstances refer to material objects and interactional aspects constituting a research environment as it bears upon a scientist's, research process activity. In a concrete sense, circumstances include differential access to research equipment and facilities, local data collecting techniques and the like. Knorr-Cetina (1979) is used here to exemplify differential access to research equipment.

For scientist D (who had arrived at the institute a few months earlier), the existence of K's laboratory represented a tremendous opportunity, since such resources were quite rare. D had no trouble using the laboratory for the first time, since K was interested in observing his procedure (also directed toward protein recovery) and acquainting his staff with it. On the second occasion, D tried to gain access to K's laboratory without K knowing. Since it was well-known that K insisted he be co-author of all papers based on research done in his laboratory, D's 'excuse' was that he had run out of protein, his actual intent was to add a very important step to the procedure which would alter the colour and biological value of the recovered protein. When K was officially asked for 'his' laboratory, he threw up the expected roadblocks, finally agreeing to a lab date which left D too little time for preparation. With the aid of co-workers, K made sure that D adhered to the exact procedure he had used initially. D tried to either smuggle his step into the procedure or negotiate with the laboratory staff for its inclusion, but failed. As a result, he had to abandon his original plans.

Some months later K read D's published results from the initial trial (K of course, was co-author, since his laboratory had been used). Afterwards, K urged D to repeat his tests, which D saw as an attempt to make sure that the procedure worked and that his own staff was thoroughly familiar with it. D agreed to this after deciding to include the additional step once again in a revised version which he thought would go unnoticed. This effort met with success (Knorr-Cetina 1979:358-359).

The state of affairs excerpted at length above bears testimony that circumstances are ubiquitous in the practice of science. From what Knorr-Cetina says above, it follows that the ability of a scientist to effect transformations is often dependent on the circumstances surrounding his attempt to effect the transformations.

Rorty says that 'anything is, for the purposes of being inquired into, 'constituted' by a web of meaning' (Rorty 1982:199). In line with Rortys statement, Woolgar - in legitimising the notion of representation in ethnographic anthropology - observes that 'scientists artistically *construct* their external world' (Woolgar 1988a:430, original emphasis). On a practical plane, to constitute something is in all intents and purposes similar to constructing something. Operating within the purview of the concepts of constitute and construct, Woolgar (1988b:chaps. 4,5) traces the intellectual evolution of the pulsar. Woolgar depicts the activity of a group of astronomers in terms of how the astronomers first created and constituted the existence of the object (pulsar) from interpretation and existence of the object (pulsar) from interpretation and documents (literary inscriptions or texts), viz. radio-telescope charts, previous results, detection apparatuses, the astronomy literature, prevailing opinions in the scientific community, and the like. Subsequently, the group of astronomers subtly embarked on a process of splitting and inversion. As a result the object now was interpreted as a separate entity which had been 'out there' all along and had given rise to the documents; although the object had been constituted - before the subtle process - by virtue of the documents and, more generally, the social networks of which documents were a part (Woolgar 1988b). Finally, the interpretative and rhetorical details of this process were minimized, denied, or backgrounded as history, rewritten to give the discovery ontological ground and status. Another history of science case within the constructivist perspective is Pickering (1984, 1989) concerning quarks. Quarks are elementary particles contained in protons and neutrons (Pickering 1984). 'The proton and the neutron are each made up of other particles called quarks which are bound together so strongly that they cannot be separated' (Kingfisher 1993:670). Quarks become meaningful only with the conceptual and theoretical tools of contemporary physics (Pickering gives a history of post-world War II high energy physics (HEP), with a focus on how quarks were constructed. He describes 'the historical progression of quark construction' (Pickering 1989:26). He bases his description upon empirical data from two sources: papers in high energy physics and interviews with some of their authors and his experience as a researcher in elementary particle physics by virtue of which he is able to interpret the literature. Thus, Pickering, a sociologist, comes to give an account of the historical accounts, focusing on Close (1983), a historian of science. The accounts of Close and Galison can be seen systematically as editing the available historical material to enforce the view that the weak neutral current (discovered in 1973 and marked a watershed in the development of elementary particle physics) is part of the furniture of the world (Pickering 1989). But Pickering then goes on to demonstrate at length, that when the editing strategy is relaxed, a social constructive view of the phenomena of the weak neutral current can be more appropriate, namely the substance of the discovery has to be understood in relation to the situated practices of the physicists involved (Pickering 1989).

Operating within the constructivist frame of reference, Weinghart et al (1990) argue that scientific reality is not limited to one authoritatively determined dimension. Scientific research areas are often described differently - for example, by those who define science policy programmes versus those by peers making expert judgements in the review process. In a similar vein, Dolby notes that 'it is only when different groups with different theoretical approaches to similar problems are exposed to one another in scientific debate, or in historical comparison, that contrasting presuppositions become clear' (Dolby 1972:316). An example of what Weignhart et al and Dobly are talking about is a study by Nicolson (1989).

Nicolson critically examines the French and

American (USA) systems to plant ecology often used to explain the difference between the two schools. The explanation of the ecology of ecologists approach - holds that differences in classification systems result from systematic differences between the characteristics of the world's vegetational regions, thereby perpetuating pluralism and lack of unity of practice (Nicolson 1989). He examines the plant ecology system evolved by F. E. Clements in the USA, and those derived from J. Braun-Blanquet's theories (based on the Zurich-Montpellier or Southern European School) with respect to their development and articulation. Nicolson shows that vegetational classification schemes are social conventions, created through the process of investigation. He also shows that the USA and French schools differ because of the differing social and professional contexts of the researchers who created them, not because of unique elements in the environment (Nicolson 1989).

According to Kuhn (1970) normal science makes progress under a unifying paradigm while the humanities flounder among competing paradigms. Lack of paradigm unity renders field-wide or discipline-wide research objects diffuse and impedes assimilation of individual papers in general. In what can be construed as giving credence to Kuhn's paradigmatic contrast of natural sciences and humanities, Mitchel (1988) describes some practical tests for judging science (production of universal laws and theories, refutation of such products and abandonment of refuted theories and laws) and then argues that these tests are frequently not met. Mitchel offers examples from psychiatry, sociology and penology as applied to the legal arena to demonstrate that these disciplines lack adequate scientific ground. In a similar study Lowy (1987) discusses the ethical component at work in medical decisions. In a sense, the discussion is a contribution to the debate over the bioethics. He points out that when confronted with difficult choices based on scientific criteria (even if they are not solidly established) rather than ethical criteria. Lowy says that medical doctors prefer to make the decision-making process as objective as possible. This objectivity - real or imagined - helps them to tolerate more easily the stress linked with therapeutic uncertainty and contributes to improving the cohesion of the medical team. It also facilitates a consensus between medical doctors and patients. In other words, objectivity legitimizes medical practice as a science rather than as an art, even when the criteria for objectivity are dubious, thereby having consensus (social solidarity?) between doctors and patients.

The term science has two senses, namely science as authority and science as a way of knowing. Mitchel's (1988) discussion pertains to science in the former sense. It deals with science as a way of knowing about nature and man. As such, it has to do with the sociology of scientists rather than the sociology of science (which is the focus of the constructivist perspective). Goldenberg (1989) study is an example of the sociology of scientists. He used a survey data to analyze the views of science expressed by a sample of 476 natural and social scientists in high quality university programmes in North America. His findings revealed a strong relationship between the field and view of science, with natural scientists adopting more traditional views (for example, the classical view that scientists do research to find truth) and social scientists espousing more modern relativistic and constructivist views (for example, the notion that scientific truth is in principle impossible to find). However, when he desegregated these field differences the results suggested that it is nonetheless simplistic to adopt the 'two-cultures' stance in this regard, for some social sciences disciplines appear to be more traditional than some natural sciences and vice versa. Furthermore, views of science appear to be quite volatile, with considerable majority of both social and natural scientists changing their views

substantially over the course of their careers. This revelation of Goldenberg's research validates Dobly's (1989) argument; the existence of tension within science between those who contend that there is tension among scientists who hold the view that science is unquestionably reliable and those who argue that science is open to revision.

The main conclusion from the foregoing discussion is that scientific facts are constructed through various social processes, involving credibility, circumstances and negotiations over what constitutes reality among scientists. Resources, such as credibility, access to certain equipment and facilities, help from colleagues and esoteric research skills, work in this direction. In the process, initial observations and measurements are transformed into new modes of presentation for the sake of persuasion. The scientific facts presented in papers and ultimately accepted by others are not necessarily descriptions of the real world 'out there'. Scientific truth is thus usually truth by agreement, a social kind of truth.

**Realism and Relativism**

One of the purposes of research is to increase knowledge. The concept of knowledge has two attendant questions: what does knowing mean, and how do we know what we know? These are epistemological questions and their discussion by philosophers, among others, usually boils down to the question: 'How can we be sure that such-and-such is true' (Naroll 1973:25)? Generally, there is no satisfactory answer to this question, even in the easiest form. Realist and relativist conceptions of science differ in their answers to this question. The realist conception is that 'science tries to find out the 'truth' and 'truth' consists of statement that correspond to 'reality' (D'Andrade 1995:403). The relativist conception is that the nature of the material world is ambiguous for scientists and non-scientists alike (Gieryn 1983; Christian 1987; Dolby 1982; Downey and Rogers 1995). Indeed Musso (1990) in a historical review of the problem of demarcation between science and common sense reveals that scientific relativists Kuhn (1970), Popper (1972) and Bloor (1976) undermined the traditional separation between science and other forms of knowledge.

The notion that scientific knowledge is socially constructed (as demonstrated in this paper) implies a relativist epistemology. However, not all social constructivists are relativists. For example, Fuller (1993) rejects the idea that science is a body of 'social' truths arising from the use of rational procedures to uncover inherent properties of nature. In this sense he is a social constructivist, but unlike many others who adopt this label (e.g Latour and Woolgar 1986; Shapin and Schaffer 1985; Latour 1988) he does not advocate a relativist view of scientific methods and facts. This is different from Grediaga (1987), a social constructivist and epistemic relativist, who argues that observable facts are relative to the point of reference adopted.

**Social Constructivism and Relativism**

The epistemic underpinning of the constructivist account of scientific practice is relativistic. According to Knorr-Cetina 'epistemic relativism is not committed to the idea that there is no material world or that all knowledge claims are equally good or bad,..... Relativism is a very cautious epistemological perspective which is primarily directed against the bolder doctrines of epistemic realism' (Knorr-Cetina 1982:320-321).

Criteria for evaluation of knowledge claims, that depend on a correspondence with or isomorphism to the material world, are inadequate from a relativist standpoint because; 'what we make of the material world is grounded in Human assumptions and selections which appear to be specific to a particular historical place and time' (Knorr-Cetina 1983:321). 'The societal framework within which research takes place exercises a direct influence in the processing of theory and

data' (Shroyer 1972:211). Everything is relative in the sense that there are no absolutes (Bloor 1976). No absolute real thing can be perceived by humans. 'There exists no 'true' knowledge in the sense that there are ultimate theories and concepts independent of time and space, there are at each point in societal development, explanatory concepts and statements that are valid for the self-understanding of the individual' (Mueller 1972:103). 'It is essential to realize that Being is not the same under all descriptions, but is something different under each' (Rorty 1991:38). Science, like all other ways of knowing about the material world, originates from some point of view or perspective. Since what we know about the material world is socially conditioned, it is impossible to objectively judge the degree to which a concept corresponds to events or phenomena in the material world.

The positivist view of science with which realism is allied holds that there is a unitary scientific method and that the standard of certainty and exactness in the physical sciences is the only explanatory model of scientific knowledge. Indeed, 'As a prominent MIT physicist put it, 'all science is either physics or stamp collection' (see Downey and Rogers 1995:274).

In the social science domain, methodological practices that are mechanistic or quantitative, as in formal economics and statistical sociology, are often pejoratively referred to as scientism by anti-positivists, among others. This is because such methodologies allegedly presuppose the natural science way of knowing about the world to be applicable to social phenomena. The constructivist perspective is not scientific.

The process of social construction of scientific facts does not entail the traditional evaluative criteria which rest on the realist epistemic assumption that scientific inquiry can yield true and objective descriptions of the material world. This implies that these criteria are inadequate for sociological (and social science) inquiry. Since objectivity depends on reliability and validity, there is a sense in which it can be argued that by virtue of viewing these criteria as inadequate for the social science domain the constructivist perspective is in effect admitting that social scientific inquiry presupposes what amounts to epistemic anarchy and, as such, the inquiry yields subjective knowledge. Be that as it may, a rejection or disavowal of epistemic realism does not mean that in sociology, for example, anything goes methodologically (see Feyerabend 1978)

## Some Implications of the Constructivist Account of Scientific Knowledge for Social Science Inquiry

Granted that the social constructivist account of scientific knowledge dispenses with or relaxes the conventional criteria of evaluation of scientific knowledge, what then are the implications of this perspective for inquiry in disciplines such as sociology? There are at least two implications. First, a sociological account of scientific knowledge in terms of the constructivist perspective is itself socially constructed. Consider Latour and Woolgar's (1986) seemingly celebrated ethnography of a natural science laboratory. They admit that their own account of scientific practice was socially constructed. They attempted to transform a series of literary inscriptions (i.e field notes, interviews and the like) into a set of social scientific facts. Secondly the fact of dispensing with or relaxing the criteria can be broadly contructed to suggest that sociological (and social science) inquiry can be guided by evaluative criteria which are obtained in those disciplines fields or subjects that have never claimed to be scientific. Writers in these fields do not claim their methods to be objective. Evaluative criteria such as principles of aesthetics, used in these fields can be fruitfully employed to evaluate social science inquiry. Writers and artists evaluate their work - or knowledge, if you will - in terms of aesthetic

criteria which exist on a formal level. Social science practitioners can have recourse to the criteria for social science inquiry. The principles of aesthetics can be used to evaluate the adequacy of social scientific inquiry. Brown (1977) discusses three principles of aesthetics which are relevant, that is, point of view, metaphor and irony. In the rest of this paper, an attempt is made to discuss each of these principles as an evaluative criterion of social scientific inquiry.

## Point of view as a Technique of knowing about the Social World

The point of view as a criterion presupposes that all inquiry (scientific and humanistic) originates from some vantage point. Brown (1977) argues that the social scientist can, by distancing himself from his inquiry, become aware of his point of view. One of the virtues of distancing oneself from one's point of view - that is, adopting a reflexive vantage point - is the ability to become aware of the effects of one's own methods of inquiry on the research subjects. Thus, by utilizing a reflexive point of view, the social scientist can be aware of such problems as demand characteristics, reactive, errors and premature closure of the inquiry. Latour and Woolgar (1986) is a case in point. Their scientific laboratory ethnography was predicated on a reflexive point of view; they distanced themselves from their inquiry by treating their own observations of laboratory work as if it were conducted by a third party, their 'observer'. This approach facilitated their being aware of certain errors in observations and interviews. These errors are namely; failing to establish safeguards against interviewer bias, and failing to take adequate safeguards against the observers disturbing or changing of the situation he or she is to observe (see Webb, et al 1974; Isaac and Michael 1974). Thus a reflexive point of view affords the social scientist a means to consider or take into account the epistemological status of his or her research.

## Metaphorical Understanding and Explanation

A metaphor as an evaluative criterion in social scientific inquiry can be defined as 'seeing something from the point of view of something else' (Brown 1977:77). Metaphorical understanding or explanation of phenomena operates at a cognitive level involving juxtaposition of something familiar with something unfamiliar. A metaphor comes into play when, for instance, a person sees something which he had not seen hitherto. The person immediately compares it with something he has seen before, thereby being able to make sense of it. The comparison affords one an understanding of both the phenomena juxtaposed (or described) in the metaphor. Thus, a 'metaphor drives its points home on a two way street' (Brown 1977: 81) in the sense that if it is successful, one can come to know something new about what is familiar, as well as something familiar about what is new.

A successful metaphor entails a 'transfer of one term from one system of meaning to another' (Brown 1977: 80). Additionally, a successful metaphor contains, in some measure, an incongruity in the form of absurdity. This absurdity - logical, empirical, or psychological - has a specifically cognitive function: ' it makes us stop in our tracks and examine it. It offers us a new awareness' (Brown 1977: 84). The absurdity component of a metaphor is instanced by Goffman's dramaturgical perspective. Goffman (1959) uses a stage metaphor to describe social interaction in everyday life. The description transfers terms such as frontstage and backstage from one system of meaning, the theatre, to another everyday life. Goffman's stage metaphor contains absurdity in the sense that human interaction is rarely as well organised as a theatre production. Everyday life is rarely structured in three acts. Lastly, metaphors must be understood to be successful or effective. This means that the systems, terms or phenomena juxtaposed cannot be too

dissimilar to each other. If they are too dissimilar the metaphor will not be successful, it will not be effective, and nothing will be learned. On the other hand, if the terms juxtaposed are similar, the metaphor may be misunderstood. An example of such a misunderstanding, with particular reference to Africa, is anthropology's functionalist account of social and cultural phenomena during the heyday of colonial-imperialism. The organic or biological metaphor used in functionalism by and large came to be accepted literary. African communities were not seen as an organism (see Omoka 1980). The metaphor lost its absurdity and, hence, much of its insights. In other words, a metaphor must be 'as is' in order to be successful. It must pretend to be real so as to provide the cognitive insight necessary for any understanding to occur. If a metaphor becomes literal, as in the case of the organic metaphor in functionalism it is useless because no transfer of terms from one level of meaning to another occurs and consequently, no insight of knowledge is gained.

Just as some social science theories are better than others, so are some metaphors in terms of cognitive value. Brown (1977) puts forth three criteria for metaphorical adequacy, namely economy, cogency and range. An economic metaphor is one which makes the simplest and most parsimonious understanding of a phenomenon. In this respect consider Goffman's stage metaphor discussed earlier. Obviously, there is nothing contained in this metaphor that is extraneous to understanding social interaction. Thus, the dramaturgical perspective is an economical metaphor. If anything, Goffman's stage metaphor is too economical because people do things in everyday life situations which do not happen on stage. Metaphorical adequacy also requires cogency and comprehensiveness. An example of a cogent metaphor - especially as far as the historical and contemprary situation in Africa is concerned - is dependency theory. The dependency, kernel idea that underdevelopment and development are two sides of the same coin is at once cogent and comprehensive. Finally, an adequate metaphor should have range. This means that it should be applicable to systems of meaning other than the one in which it originated. An example of a metaphor with range is exchange theory. This theory as it emerged in Homans (1958, 1961), was originally geared to an explanation of micro-level social interaction. However Blau (1964, 1970 ) took the logic of social exchange at micro-level and applied (generalized) it to macro-level phenomena. In this way social exchange came to have range.

**Seeing a Phenomenon in terms of its Opposite**

The last principle of aesthetics suggested by Brown is irony. Irony involves seeing a phenomenon from the vantage point of its opposite. That is to say, the phenomenon is transferred from its original context of meaning to that of its very opposite. This kind of transference increases understanding of the phenomenon (Brown 1977).

In a sense, it is plausible that in terms of empirically informed writing about the process of rapid social change in Africa (and elsewhere in the so called Third World), the work of Fanon (1967, 1968) has had such great impact on the world of academia as well as popular (non-academic) theorizing. This is partly due to his effective utilization of ironies to explain and understand the social relations of politico-economic hegemony. In his theory of colonial subordination and decolonization dynamics, Fanon gives a long account of European racism. By virtue of their hegemony in producing dominant ideas, white males sexually mythicize black males through their claim of the sexual prowess in black males. This mythology is a cliché of white-on-black racism that 'fosters fear of the Negro's sexual prowess' (Fanon 1967: 162) on the part of whites. The fear, in turn, gets translated into whites' types of behaviour which keep blacks in a subordinate

position. In analyzing this racism in terms of effect (i.e. primary erotic love), Fanon uses, where appropriate, ironies such as the one below, taking the Hegelian concept of 'existing for the other' as the point of departure.

> From the blackest part of my soul, up through the streaky zones, arises all of a sudden this wish to be white. I do not wish to be taken for black, but for white. Now - and this is a recognition that Hegel has not described - who can do this except the white... In loving me (the white) proves that I am worthy of white love. I am loved as white... I am white (Fanon 1967: 162-163)

The effectiveness of this love irony derives from the fact that it is at once non-dialectal and non-ambivalent. Dialectic and ambivalence are concepts which have been extensively used in discussions of perceptions and attitudes of blacks in relation to whites. By utilizing irony, Fanon manages to avoid all this and in doing so, facilitates a greater understanding of white-on-black racism that would otherwise have been the case.

Lastly, Nkrumah employs irony in his discussion of colonialism and neo-colonialism. In his theory of decolonization and development, Nkrumah (1964) contrasts African and European conceptions of the world. In the European conception, the world has 'inside' and 'outside', whereas in the African conception, the world has no 'outside' (Nkrumah 1964:6-12). The existence, on a conceptual plane, of the 'outside' entails transcendence of the 'inside'. The effect of this transcendence is that 'a definite contradiction is created in society - the contradiction between interests inside the world and interests outside the world' (Nkrumah 1964: 12). The two conceptions are opposite in the sense that in the African conception, this contradiction is forestalled through making the inside things (visible phenomena) continuous with those which are outside (things beyond visibility). Referring to past African societies, Nkrumah states that 'these African societies didn't accept transcendentalism, and may indeed be regarded as having attempted to synthesize the dialectical opposites 'outside' and 'inside' by making them continuous, that is, by abolishing them' Nkrumah 1964: 12). He juxtaposes the African conception against the European conception by delegitimating the hegemonistic and hierarchical societal consequences of the European conception and, in doing so, legitimates the societal consequences of the African conception. Beliefs and practices deriving from transcendentalism sociologically facilitate production and reproduction of relatively acute social inequality. 'Quick confirmation can be found in Africa, Asia, Latin America and among the people of African descent in America and the Caribbean' Nkrumah 1964: 13-14).

In a sense, the notion that the world has 'inside' and 'outside' is as comparable to the notion that 'the world has no 'outside' as the notion of capitalism is to the notion of communism. Yet, by juxtaposing the African conception against the European conception, Nkrumah more ably elucidates and affords a comprehensive and insightful understanding of colonialist subordination of the people of Africa, and their extension beyond the continent than would have been the case if he had juxtaposed the notion of communism against the notion of capitalism as a way of understanding the subordination. The particular virtue of juxtaposing the African conception against the European conception is that it makes for comprehending class as well as race and cultural factors in colonial subordination. However, juxtaposition of communism against capitalism distorts the dynamics of the subordination by reducing variables pertaining to race and culture to class variables. It is important to point out in this connection that writers on postmodernism, such as Bergesen (1993), resonate with Nkrumah when they argue that even in discourses of Marxism, the determinate relationship between the material base and ideological superstructure is now no longer clearly defined.

## Conclusion

The constructive perspective in the social study of science focuses on the practice of science rather than the norms of science. That is, the object of study for the social construction of scientific facts is constituted by the social process involved in establishing those facts. The constructivist perspective in the sociology of science espouses a brand of relativism that does not deny the objective reality of external world. It also does not entertain the notion that in scientific inquiry anything goes methodologically. The perspective recognizes that conducting research often involves breaking the boundaries of orthodox wisdom and refashioning existing ideas and/or techniques in new ways. Thus, this perspective - by virtue of being underpinned by a brand of epistemic relativism than can distinguish a good social scientific inquiry from a bad one - privileges methodological heterodoxy rather than methodological orthodoxy.

Not all research in the social sciences conforms to the realist model of science. When social scientists conduct research, they rely to some degree on their powers of intuition and sense of exploration. There are social scientists who employ subjectivist (less empirical) methods and those who employ objectivist (empirical) styles of research. Fields of scientific knowledge and those of non-scientific knowledge represent, in some way, their respective worlds with metaphors. Metaphors contained in social scientific inquiry can be evaluated in terms of criteria of adequacy. If it is granted that metaphor and irony facilitate understanding of phenomena, social inquiry can, in turn, be evaluated by the metaphors and ironies it contains. Subjective knowledge can be evaluated; and employing a relativistic perspective (the social constructivist) in the sociology of science does not imply advocating epistemic and methodological anarchy.

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