

## THE INVENTION OF SCIENCE

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### ABSTRACT

Social and cultural studies of science revolutionized our understanding of science during the last quarter of the 20th century. This achievement has been accomplished in the face of great resistance and at great cost to the critics and theorists of science. In this paper, we explore some of the reasons for the resistance to and costs of analyzing science as a social fact. At the same time, we try to regain some of the momentum science studies achieved in the 1960s and 1970s. Our approach is to consider the consequences of bringing science into the dialogue on orientalism and occidentalism. We discuss the invention of science in terms of the traditions against or in opposition to which it was invented. Science, no matter how we define it, is intertwined with the industrial, and military technologies that grounded European movement into and around the world. Social theory is not only a route to critique and theory in science studies, but also a route for saving science as an intellectual enterprise.

*Key Words* \_ colonialism \_ occidentalism \_ orientalism \_ science \_ science studies

### *Science and Orientalist Discourse*

This article explores science as a stylized and essentialized image. We are especially interested in the construction of this image in the West and its transportation to non-western cultures. While the orientalism literature has addressed numerous cultural features and social institutions, science has been conspicuously absent from this discourse. This is in part because the orientalist/occidental perspective is most readily located in fields with a tradition of reflexive critique and without aspirations to the authority of science; it is also because the very image of science rejects critique: science is abstract, timeless, self-correcting.

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We want to think about ‘science’ in the context of ‘orientalist’ and ‘occidental’ discourse. Once the Orient and Occident were established in western thought and action they could not be undone. But the West exists only because the East exists. Orientalism and occidentalism are dialectically produced constructs of essentializing East and West. Our objective is to construct an orientalist/occidental inspired discourse on science. While science has been neglected in the critical literature we argue that by constructing, creating, and defining science as absolutely different from and superior to other modes of inquiry and especially from non-western modes, the West has essentialized itself, science, and the non-western world. This essentialization (occidentalism) occurs in the everyday lives of ordinary people in the West and elsewhere, and among anthropologists and other students of society and culture. The West has appropriated this view of itself as politically, intellectually, and economically advanced beyond the rest of the world, simultaneously with its appropriation of science as its own. Rendering the Third World, the West, the East, and science in essentialist terms makes them ‘timeless and radically alien’ relative to their opposed terms (Carrier, 1995; cf. Clifford, 1988; Fabian, 1983; and see Burke, 1969/1945: 24).

‘Orientalism’ and ‘occidentalism’ provide the inspiration for this paper,

but we are not interested in engaging the large and technical literature generated by these terms. Orientalism with a capital 'O' generally refers to the study of Islamic civilization and in particular 'classical Islam' (Turner, 1978: 6). The Orientalist studies the Orient, and in particular the Muslim Orient (e.g. Hourani, 1947). For eastern and western critics of western images of the East, the term 'orientalism' has come to mean 'a particular, suspect type of anthropological thought' (Carrier, 1995). We are interested in orientalism and occidentalism in part because they are products of 'an epistemology which is essentialist, empiricist and historicist' (Turner, 1978: 7).

This is precisely why it is important to examine 'science' in the context of orientalist/occidental studies. We can then begin to understand why science is widely viewed as a 'coherent, homogeneous, global entity', with its own 'dynamic history', 'punctuated by constant, progressive revolutions' (cf. Kuhn, 1972). In orientalist/occidental terms, this view of science is contrasted with the 'static history' of local non-western knowledge systems (Turner, 1978: 7).

We want to avoid essentializing occident and orient, even while doing just that is one of the consequences, even one of the goals, of theory work. These are protean categories. In the academy, in theory work, it is easy to stabilize these categories to the point of essentializing them. But the everyday reality of orientalizing and occidentalizing selves, relationships, institutions, and cultures is a messy business, just as drawing, sustaining, and changing boundaries in general is a messy business.

The strategies involved in the production of the West are those of more  
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general cultural processes. People intensify (and essentialize) the boundaries that define who, what, where, and why they are 'by dramatizing the distance and difference between what is closer . . . and what is far away' (Said, 1978: 55; see Douglas, 1966, for the general sociological theory of boundaries and margins). When we call ourselves scientists, we are being scientists against some other form(s) of inquiry (Carrier, 1995). But the production of the West as legitimately dominant, as the measure of all culture, requires more than this development of boundaries. It involves the creation of the Other, the non-West, the repository of the complementary and inferior characteristics which the West may use, appropriate, discipline, and judge. The West requires the invention of sex, gender, and race to explain and legitimate the dominance of the West as both idea and structure (Schiebinger, 1989, 1993; Torgovnick, 1990).

Orientalism includes the notion of the 'mysterious East', and fuels the many 'journeys to the East' that westerners have embarked on in search of riches, new worlds, new knowledge. But all of the ingredients of the mysterious East have been available within the West's own boundaries (Restivo, 1983: 91-120). The science that scientists and their surrogates, imitators, worshippers, and ideologues imagine is as 'partial and distorted' as their renderings of non-western science and of those who 'threaten' science (see, for a glaring example, Gross and Levitt, 1994).

Efforts to 'unite' science and non-science in most postmodern discourse are imperialist and colonialist in principle. These efforts are grounded in a concept of science and ultimately of 'the western subject' as universal norms. To approach this in terms of an orientalist/occidental or nordist/australist perspective connects the theory and critique of science to 'the secular notion of an individual "I" as an abstract and universal consciousness free of all embodiment and locality' (Yegenoglu, 1998; on the north/south divide, see Diamond, 1998; Richards and Ruivenkamp, 1996; Seabrook, 1993; Strathern, 1992). The western subject (already gendered to subordinate the female and the feminine) is brought into being as a universal

norm in the process of the West's expansion. This norm denies the subject's dependence on 'the other' and produces the illusion of autonomy and freedom. In fact, this abstract and universal *consciousness* was always embodied, male, and European, whether indigenous or transplanted. Women and non-European men—even if they achieved the required education—could enter science only as surrogates, disciples, or through passing (that is, by adopting the language, gestures, attitudes, and values of Euro-American men).

The social institution of science, rooted in the western subject, analogously denies its dependence on the other's knowledge (indigenous, local knowledge). 'Science' is not an absolute positivity opposed to an absolute negativity called 'non-science'. If we were Hegelians, we might suppose that science and non-science conflicts arise and get resolved 'dialectically'.

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An alternative to attempting a dialectical resolution of the science/nonscience dichotomy is to revalue non-science, 'the other', and then to locate non-science in the very core of science itself. The objective is to interrupt the economy of science, to go beyond the simple demonstration of the hegemony of (western) science. The objective is to interrupt the creation and recurring re-creation of the sovereign, possessive, unitary position of science (cf. Yegenoglu, 1998).

#### *The Image of Science*

This article is not simply about the social fact that science was invented, but about the traditions against or in opposition to which it was invented, and in relation to which it has sustained itself (cf. Thomas, 1992a: 216). Science gives the appearance of being firmly grounded in the real world with a concrete referent, but this is an illusion. Science is neither a special kind of thought, a method guaranteeing truth, nor a unique organization of work. In terms of social practice and discourse, the meaning of science came into focus only in opposition to the terms 'pre-' and 'proto-science'. 'Modern science' makes sense, in part, by way of its opposition to 'ancient' and 'medieval' science. All of these terms are created as part of a Europeanized history of the West and of the world. In the context of the anthropologized societies that would later be designated the East, the Dark Continent, the New World, the Third World, the South, the oppositions between 'science' and 'non-science', and increasingly in the 20th century between 'science' and 'local' or 'indigenous' knowledge, strengthened. We are not thinking here of the word 'science' being introduced into the English language, but of the process of integrating the word 'science' into vocabularies of meaning, action, and social institutions. It is during this process of integration (and institutionalization) that science takes on its (dis)guise of universality. Orientalism is a knowledge apparatus with a will-to-truth (Yegenoglu, 1998; cf. Said, 1978). As sociologists of science, we need to take seriously Said's demonstration, based in Foucault's conception of discourse, of Orientalism's connection to 'objective' scholarship. This suggests a certain complicity between general academic discourse and scientific discourse in particular and the structures engaged to subjugate and administer 'other' cultures. The discursive mechanisms of science define what can be said to be true, what we are allowed to recognize as truth. By linking orientalism, occidentalism, nordism, and australism, we build a bridge to the insight that western science—modern science—has been essentialized. Said (1978: 72), recall, considered Orientalism (as language, thought, and vision) 'a form of radical realism'. And like the figures, tropes, and images associated with the Orient, those associated with 'science' are

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'declarative and self evident; the tense they employ is the timeless eternal'. Science in this sense is 'per se', conceived of and written and spoken about in what Restivo has called the 'grammar of the ever-present tense' (e.g. Restivo and Bauchspies, 1997: 399–400). It takes little more than the copula 'is' to essentialize science.

*How shall we Think about Science?*

People think about themselves in terms of their encounters with other people, and this principle has a cultural analog as well as an epistemological one. The colonial nations did not experience intrusive western science as neutral and objective, any more than the colonialists and their knowledge brokers viewed 'native epistemologies' as neutral and objective. Orientalisms are created out of a dialectic that also produces occidentalisms. The overall result in the realm of knowledge is essentialized and opposed epistemologies (Carrier, 1995; cf. Collins, 1990: 221; Thomas, 1992b: 82). These essentialized epistemologies are positioned differentially with respect to power in terms of gender, race, sex, and class. They are produced by and for the West and by and for the East, in pro- and anti-colonialist/imperialist contexts and contests. In the textbook versions of science that train the public to appreciate it, science discovers the world. If scientific knowledge changes, if errors occur, these are errors of method, of observation, of logic, or instrumentation; science remains a 'truth machine'. Thus science can claim to know, to understand, the peoples of the world better than they know themselves. The self-knowledge of the Other is prejudiced, not objective, and she cannot speak on her own behalf. In fact, like any discourse, scientific discourse creates the very reality it describes. Deborah Root uses PBS (Public Broadcasting System) and *National Geographic* magazine to make the point that 'with educational programs the Western viewer can still find foreign cultures titillating and exotic, but s/he gets to feel good about it, even edified, as the images appear in the name of science' (Root, 1996: 34 n. 4). This is not a new idea in science studies, but it has come under attack in the Science Wars, and has lost some of its edge in science studies itself. It is therefore necessary to continue to reiterate this fundamental constructionist concept, and to do so in different contexts and frameworks, and from different perspectives and standpoints. It is important to stress that representing, classifying, categorizing, and essentializing are offensive and defensive strategies human beings use in making their way collectively through the world. These strategies, tested in conversation and action, are basic to science, as to all knowledge construction. So the point here is not to criticize these processes, but to step back and ask what is going on at some particular historico-cultural juncture. When these processes are halted by force, when knowledge becomes static,

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enforced by authority, organized into inflexible social relationships, taught rather than discovered, then knowledge is in the service of power. Dominance is possible only when legitimated by ideologies which can enforce consent and delegitimate resistance. The West orientalized the Noble Savages of the Americas, Africa, and the Pacific first as the enemy, brutal, warlike, and dull. Now the same lens on the Noble Savages puts in view an exotic remnant of a romantic past and reveals them to be generous, peaceful, dignified, and wise ecologists. The West claimed to bring salvation and civilization to the rest of the globe, but

now is occidentalized as 'violent, rapacious, and heedless' as non-western scholars challenge and criticize western society and culture. This critique of the West's assumed charge of global discipline, imperium, and colony is now part of standard scholarship (Smith, 1985: 80–5; see McNeill, 1963: 569). The image of science, however, remains timeless, abstract, independent of ideology. The significance of portraying science as an essentialized representation will be missed if it is not seen in the context of the history of western expansionism. It is impossible for modern science to have escaped from this process, impossible that it could have crystallized outside of the arena of the ideologies, mythologies, and practices of commercial and mercantile revolutions, colonialism, and imperialism. The problem is to determine the impact of this history of modern science on the knowledge it has produced.

We need to be able to determine the historical, social, and cultural sources of scientific knowledge without leaving ourselves open to the charge that we are supporting irrationality, or adopting anti-objectivity or anti-truth strategies. The fact is that postmodernism in general and the sociology of scientific knowledge in particular have not, as Science Wars critics would have it, destroyed the possibility of telling the truth. Dorothy Smith (1999: 96–130) has elegantly argued that postmodernism and sociology have actually given us grounds for telling the truth and understanding our claims.

#### *Science and the Creation of the West/East*

One way to measure the degree to which modern science and the modern world or global system are interrelated is to consider the impact European societies have had on that system. That impact, according to Alfred W. Crosby, Jr (1972: 218–19), is comparable to 'an increase in the influx of cosmic rays or the raising of whole new chains of Andes and Himalayas'. Science, no matter how defined, is intertwined with the agricultural, industrial, and military technologies that grounded European movement into and around the world. Londa Schiebinger argues that the destruction of cultures and their knowledge of flora and fauna suggests that 'the explo-

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sion of knowledge associated with the rise of modern science resulted in a loss of knowledge in the long run' (1993: 209). In summarizing her studies, she notes that 'Europeans modeled plant sexuality on culturally sanctioned heterosexual unions, saw mammals as essentially breasted, made the investigation of sexual and racial difference a priority of the medical sciences.'

This 'cannot be blamed on the shortsightedness of a few individuals alone, but rather can be traced to broader social trends of which science was a part' (Schiebinger, 1993: 210). It is only when science is defined as 'ideas', and especially as free-standing, free-floating ideas, that science as a social force and as a product and construct of European expansionism, can be made to appear negligible. Fortunately, research and theory in science studies make it difficult to sustain such a conception of science.

Another way to demonstrate the intricate way in which modern science is intertwined with the other major institutional structures of the modern West is to follow the lives of individual scientists. Captain James Cook, who played a key role in European expansionism, was elected to membership in the Royal Society in 1776. Shortly after his election, he was awarded the Society's Copley Medal, 'awarded annually to an individual who had made outstanding contributions to science' (Withey, 1987: 308). Joseph Banks had convinced Cook and other explorer navigators that it was a good idea to include naturalists on what we euphemistically refer to as 'voyages of

exploration' (Withey, 1987: 194). When the Royal Society planned a voyage to the South Pacific in order to observe the 1768 transit of Venus, it was understood that, following their observations, the expedition would turn into a search across the Pacific for 'undiscovered' lands. The French and Spanish, reasonably suspicious of England's earlier expeditions, understood along with the rest of Europe the scientific significance of careful observations of the transit of Venus. Of course, the Royal Society's scientific rationales included pointing out the importance of astronomy to navigation. The political and economic grounds of the Royal Society's rationales and arguments were quite evident 'in a nation where economic and political power was based on the sea' (Withey, 1987: 19). Scientists like Banks understood quite well the meaning of 'colonies', 'markets', and 'returns' on investments of people and materials in the 'new worlds' (Crosby, 1986: 297-8). Representations and images of science were co-constructed with representations and images of European explorations, expeditions, and expansions. This is an important part of the rationale for including science in the orientalism/occidentalism analytic framework. Sowell (1998: 37) points out that industrialization produced engineers and mechanics along with materials and machinery and goods. It produced inventors too. It does not require a large leap of inspiration to recognize that industrialization also produced scientists. These scientists were, and would continue to be, employed by the state, by industry, and in education. Essentialized representations or images of science and non-science are not Restivo and Loughlin: *The Invention of Science* 141

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constructed in vacuums, but in complex sociocultural contexts of power and inequalities. They have social and cultural functions and they shape actions and ideas. The West's capacity to control the essentialization of science and non-science has been proportionate to its control of more powerful technologies of violence, modes of transportation, and warfare. Western scientists have for the most part been culture blind to the ways in which their science and they themselves have been occidentalized, and doubly blind to how the occidentalisms infecting science have been shaped by the West's role in world political economy, and the political economy of the West 'itself'. Whether in their laboratories or as ambassadors of science abroad in the colonial and postcolonial world, scientists bring with them occidentalized selves and sciences. This is the root of the dangers in talk about 'universal truths', and 'universal science'; for how far is this from talk about the universal relevance of the morality, logic, and world-view of the West (cf. Carrier, 1995)? Scientists' conception of themselves as practicing a neutral methodology has helped to shape their occidentalist consciousness. The dollar is not the only token of western superiority (notwithstanding the fact that, in the face of the yen and the new euro, that superiority faces serious fin-de-siecle challenges). Science, re-presented in the white lab coat and the sparkling laboratory, is in fact the most important token of western superiority, especially since it is carried into the non-western world on the wheels or rockets of technology. This technology is not merely physical machines. It includes the bureaucratic organization of state, education, and labor, legitimated as scientifically efficient and just. It includes the extension of western religion, which would negotiate a peace with science, and the gender and family systems which supported the institutions and were demanded by religious authority (Trexler, 1995). It includes language, the European languages of science, state, education, and work, which would make some knowledge unspeakable. It includes an aesthetic which would

define indigenous representations as artifact and western representations as art (Price, 1989; Root, 1996). Orientalisms and occidentalisms draw boundaries between and within societies (Carrier, 1995: 22). So the West is scientific, the non-West is not; physicians are scientific, midwives and alternative healers are not; chemists are scientific, wives and husbands in their kitchens are not (Collins, 1990). This process is most pronounced, in general, in those societies that border occident and orient. If our focus is on science, then the process of orientalizing and occidentalizing should be most pronounced just at the boundary(ies) between science and the humanities, and even more so at the boundary(ies) between science and social science. We should expect these essentialisms to be most exaggerated in those cultures and nations that sit on or around the geographico-symbolic boundaries between East and West.

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The resources for challenging western hegemony started to accumulate in the wake of the social and political fallout from nuclear tests and the bombing of Hiroshima and Nagasaki. A second stage of this accumulation occurred with the emergence of ecological consciousness, and the criticisms of the technoscientific Indo-China war. More recently, various technoscientific activities centered on genetic research have contributed to the accumulation of grounds for criticizing and challenging western hegemony. The combination of social and political criticisms of science and Westernism and the emergence of a theoretically powerful empirically grounded social analysis of science and technology has fueled Cultural and Science Wars. Defenders of Westernism have rebelled against multiculturalism, feminism, postmodernism, and the sociology of science in defense of traditions from Greek philosophy and Christianity to Elizabethan drama and modern science that they claim hold universal truths and values. These efforts to maintain the privilege of the West have grown in opposition to efforts by the underprivileged, the underrepresented, the disenfranchised, disinherited, disempowered, and formerly and currently colonized territories, countries, and peoples to enter the world cultural arena as citizens and human beings. These efforts, whether they have emerged in the inner cities of the West or in the emerging nations of Africa, have all been orientalized, that is, they have been defined as ungrounded, emotional, irrational, ignorant, impulsive—in a word, unscientific. Or worse, perhaps, to use the term preferred by Gross and Levitt (1994), they are merely ‘superstitions’. There have, of course, been earlier globalists among historians of science. George Sarton, Paul Tannery, and Joseph Needham (Pyenson, 1993) gave us provocative and profound ecumenical views of science decades before the multiculturalists. But their international humanism and ecumenical socialism had limits. Ideology enters everywhere in this discourse as we contrast the views of the ecumenical historians of science with the views of Goonatilake (1998) and Frank (1998). But it is evident that ‘the complementarity and filiation of East and West’ that was thematic in Sarton’s work has been incrementally documented to an extent and with results undreamt of by the Sartons and Needhams. We are now better placed than ever before to move beyond their ecumenical humanism to a more profoundly anthropological understanding of science in history and culture. More importantly, we can move beyond this level of understanding by taking seriously the theory of social construction, but not as interpreted by its critics nor as practiced by its more conservative exponents. Social construction as it is demonstrated in classical social theory is radically transforming

in a social science that has failed its heritage. If we conceive colonialism and colonization as structures of domination (of physical spaces), reformation (of indigenous modes of thought), and integration (of local

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political economies into western techno-industrial capitalism) (Mudimbe, 1988: 2), then an interesting conclusion follows. To reach this conclusion, we have to follow the logic of purity and danger, of boundaries and margins. Dominating, reforming, and integrating in the colonial situation reforms the colonizers' modes of thought and histories.

The colonializing structure actualized a dichotomization of modes of thought. This is in great part one of the consequences of negotiations, conflicts, and cooptations among elites, and transformations in those dynamics over time. This was not a new situation in general, but under the specific circumstances of colonialism, the dichotomies were exaggerated and multiplied: traditional and modern, oral and written and printed, agrarian and urban, subsistence and techno-industrial economies (Mudimbe, 1988: 4).

Science is a discursive order; it cannot have escaped transformation during the colonializing process. The project of rethinking science and the possibilities for postcolonial (including feminist) scientific discourses can be compared to the movement by French and African Marxists during the 1960s to construct 'a new discourse' uniting categories and classifications that had been separate (Mudimbe, 1988: 177; see e.g. Meillassoux, 1964, 1974). As Marxists they worked within a scientific framework that made it impossible for their new discourse to unite science and non-science. This challenge is the objective of the current project. The science celebrated in the West is invented outside of western awareness in the same way that western history is celebrated while placing its invention out of awareness (Wagner, 1981: 158).

Foucault (1972: 235) wrote about appreciating exactly the price of escaping, or trying to escape, Hegel:

It assumes that we are aware of the extent to which Hegel, insidiously, perhaps, is close to us; it implies a knowledge, in that which permits us to think against Hegel, of that which remains Hegelian. We have to determine the extent to which our anti-Hegelianism is possibly one of his tricks directed against us, at the end of which he stands, motionless, waiting for us.

Our task is to escape Plato. We do not believe that Plato played the same kinds of tricks in this sense as Hegel. However, Platonized and Hegelianized, we must be aware of tricking ourselves! And indeed, this is what we have done in generating the so-called 'Science Wars'.

The Science Wars arise in part because of a failure to attend to the distinction between science as social institution ('modern' science), and science as the basic social activity human beings engage in as they make their way through the worlds of everyday life. Scientists such as Bridgman (1950) and Schrodinger (1957: 88) found 'the origin of science' in the fundamental requirements of our 'struggle for life' and the fullest exercise of our intelligence. The sociologist Bernard Barber (1952) argued for what seemed to be a similar view of science as the basic form of human ration-

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ality. As one of the first sociologists of science, he added a social dimension missing from earlier views championed by physical scientists and philosophers of science. We (Loughlin and Restivo, 1997: 64) have written elsewhere about science as 'a strategy for producing defensible knowledge, grounded in shared experience rather than authority—knowledge which

has a strong but tentative status as the basis for action'. This view of science is one we want to defend against all competing forms of inquiry. Science in this sense is no more invented than our ability to breathe or to think. It is science as a modern social institution that is invented, and it is this invention that we theorize and criticize.

#### *Can Science be Saved?*

We intellectuals who value thinking, inquiry, and education want in some way and some sense to save science. But we must be attentive to the sustainable lessons of postmodernism and the social science of science. Science cannot be saved as an excuse for the West's ambitions. It cannot be saved as a morally autonomous truth machine. Science cannot be saved as a way of organizing labor that subjugates others. It cannot continue to have the 'luxury' of excluding knowledge from others and knowledge of the Other. Science can, however, be saved as a way of telling the truth. To achieve this, we have to understand telling the truth in a radically social way (Smith, 1999: 96–130).

#### *Conclusion*

Theorizing science in the way we have implies that science is 'alwaysalready constituted' within a discourse. This could argue for the suspension of a concern with reference. This follows only from a mistaken reading of deconstruction (Derrida, 1984: 123). In the context of this paper, the problem of reference and realistic knowledge is more complex and problematic than is apparent to the heirs of positivism, naive realism, and scientism and those still carrying the latent forms of these -ism viruses (cf. Yegenoglu, 1998).

The recent lessons of the history and sociology of science demonstrate more strongly than ever that science is not a unified, universal, homogeneous monolith except in its various Vienna-circled representations (e.g. Galison and Stump, 1996). Indeed, if we focus our attention on the epistemic machinery of science we find that science per se 'displays different architectures of empirical approaches, specific constructions of the referent, particular ontologies of instruments, and different social machines' (Knorr-Cetina, 1999: 3; cf. Dupre, 1993; Hacking, 1983; Suppes, 1984).

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Science disappears amid a disunified set of epistemic cultures. But each of these epistemic cultures, whether social sciences or physical sciences, exists within the larger culture. Donna Haraway's *Primate Visions* (1989) and Sharon Traweek's anthropology of high-energy physics (1988), are excellent case studies of the social nature of science.

Essentialization is correlated with naturalization. It aids in the development of a contagious sense that things could not be otherwise (cf. Butler, 1993: 7–8). Some readers, like ourselves, will be tempted to regard the sort of general theorizing we are engaged in as essentializing. However, as unabashed general theorists we are not so obsessed with specificities that we can be driven out of general theory by one 'irrefutable' counterexample (cf. Yegenoglu, 1998). It is furthermore important to underscore that essentialism is about binary oppositions. Our theoretical orientation does not take us in the direction of dissolving essentialisms but rather of helping to identify how—in our case—science becomes a naturalized essence in the course of its institutionalization. This is what we have tried to do in this paper, reveal again for the first time and from a different perspective, another standpoint that science is an episteme, and an epistemic regime (Elzinga, 1993).

## REFERENCES

- Barber, B. (1952) *Science and the Social Order*. New York: The Free Press.
- Bridgman, P. (1950) *Reflections of a Physicist*. New York: Philosophical Library.
- Burke, K. (1969/1945) *The Grammar of Motives*. Berkeley, CA: University of California Press.
- Butler, J. (1993) *Bodies that Matter*. New York: Routledge.
- Carrier, J.G. (1995) 'Introduction', in J.G. Carrier (ed.) *Occidentalism: Images of the West*, pp. 18–32. New York: Oxford University Press.
- Clifford, J. (1988) *The Predicament of Culture*. Cambridge, MA: Harvard University Press.
- Collins, P.H. (1990) *Black Feminist Thought*. New York: Routledge.
- Crosby, A.W. Jr (1972) *The Columbian Exchange*. Westport, CT: Greenwood.
- Crosby, A.W. Jr (1986) *Ecological Imperialism: The Biological Expansionism of Europe, 900–1900*. Cambridge: Cambridge University Press.
- Derrida, J. (1984) 'Deconstruction and the Other', in R. Kearney (ed.) *Dialogues with Contemporary Continental Thinkers*, pp. 105–26. Manchester: Manchester University Press.
- Diamond, J. (1998) *Guns, Germs, and Steel*. New York: W.W. Norton & Co.
- Douglas, Mary (1966) *Purity and Danger*. London: Routledge & Kegan Paul.
- Dupre, J. (1993) *The Disorder of Things*. Cambridge, MA: Harvard University Press.
- Elzinga, A. (1993) 'Science as the Continuation of Politics by Other Means', in T. Brante, S. Fuller and W. Lynch (eds) *Controversial Science: From Content to Contention*, pp. 127–52. Albany, NY: SUNY Press.
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- Fabian, J. (1983) *Time and the Other*. New York: Columbia University Press.
- Foucault, M. (1972) *The Archaeology of Knowledge*. New York: Pantheon Books.
- Frank, A.G. (1998) *ReOrient: Global Economy in the Asian Age*. Berkeley, CA: University of California Press.
- Galison, P. and D.J. Stump (eds) (1996) *The Disunity of Science: Boundaries, Contexts, and Power*. Stanford, CA: Stanford University Press.
- Goonatilake, S. (1998) *Toward a Global Science*. Bloomington, IN: Indiana University Press.
- Gross, P.R. and N. Levitt (1994) *Higher Superstition*. Baltimore, MD: The Johns Hopkins University Press.
- Hacking, I. (1983) *Representing and Intervening*. Cambridge: Cambridge University Press.
- Haraway, D. (1989) *Primate Visions: Gender, Race, and Nature in the World of Modern Science*. New York: Routledge.
- Hourani, A.H. (1947) *Minorities in the Arab World*. London: Oxford University Press.
- Knorr-Cetina, K. (1999) *Epistemic Cultures: How the Sciences Make Knowledge*. Cambridge, MA: Harvard University Press.
- Kuhn, T.S. (1972) *The Structure of Scientific Revolutions*, 2nd edn. Chicago, IL: University of Chicago Press.
- Kumar, P.V.S. (1993) 'Biotechnology and Biodiversity: A Dialectical Relationship', *Journal of Scientific and Industrial Research* 2: 523–32.
- Laqueur, T. (1990) *Making Sex: Body and Gender from the Greeks to Freud*. Cambridge, MA: Harvard University Press.
- Loughlin, J. and S. Restivo (1997) 'Race Class and Gender in Science Studies', in J. Barmark and M. Hallberg (eds) *Festschrift to Professor Aant Elzinga on his 60th Birthday*, pp. 57–75. Gothenburg: Theory of Science Department, University of Gothenburg.
- McNeill, W. (1963) *The Rise of the West*. Chicago, IL: University of Chicago Press.
- Meillassoux, C. (1964) *Anthropologie économique des Gouros de la Côte d'Ivoire*. Paris: Mouton.
- Meillassoux, C. (1974) *L'Esclavage dans l'Afrique pré-coloniale*. Paris: Maspéro.
- Meillassoux, C. (1981) *Maidens, Meal and Money: Capitalism and the Domestic*

- Community*. Cambridge: Cambridge University Press.
- Mudimbe, V.Y. (1988) *The Invention of Africa: Gnosis, Philosophy, and the Order of Knowledge*. Bloomington, IN: Indiana University Press.
- Price, S. (1989) *Primitive Art in Civilized Places*. Chicago, IL: University of Chicago Press.
- Pyenson, L. (1993) 'The Ideology of Western Rationality: History of Science and the European Civilizing Mission', *Science and Education* 2: 329–43.
- Restivo, S. (1983) *The Social Relations of Physics, Mysticism, and Mathematics*. Dordrecht: D. Reidel/Kluwer.
- Restivo, S. and W.K. Bauchspies (1997) 'How to Criticize Science and Maintain your Sanity', *Science as Culture* 6(3/28): 396–413.
- Richards, Paul and Guido Ruivenkamp (1996) 'New Tools for Conviviality: Society and Biotechnology', in P. Descola and G. Palsson (eds) *Nature and Society: Anthropological Perspectives*, pp. 275–95. New York: Routledge.

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- Root, D. (1996) *Cannibal Culture: Art, Appropriation, and the Commodification of Difference*. Boulder, CO: Westview Press.
- Said, E.W. (1978) *Orientalism*. New York: Vintage Books.
- Schiebinger, L. (1989) *The Mind has No Sex*. Cambridge, MA: Harvard University Press.
- Schiebinger, L. (1993) *Nature's Body: Gender in the Making of Modern Science*. Boston, MA: Beacon Press.
- Schrodinger, E.C. (1957) *Science and Theory and Man*. New York: Dover.
- Seabrook, J. (1993) 'Biotechnology and Genetic Diversity', *Race and Class* 34(3): 15–30.
- Smith, B. (1985) *European Vision and the South Pacific*, 2nd edn. New Haven, CT: Yale University Press.
- Smith, D.E. (1999) *Writing the Social*. Toronto: University of Toronto Press.
- Sowell, T. (1998) *Conquests and Cultures: An International History*. New York: Basic Books.
- Strathern, M. (1992) *Reproducing the Future: Anthropology, Knowledge and the New Reproductive Technologies*. Manchester: Manchester University Press.
- Suppes, P. (1984) *Probabilistic Metaphysics*. Oxford: Blackwell Publishers.
- Thomas, N. (1992a) 'The Inversion of Tradition', *American Ethnologist* 19: 213–32.
- Thomas, N. (1992b) 'Substantivization and Anthropological Discourse: The Transformation of Practices into Institutions in Neotraditional Pacific Societies', in J.G. Carrier (ed.) *History and Tradition in Melanesian Anthropology*, pp. 64–85. Berkeley, CA: University of California Press.
- Torgovnick, M. (1990) *Gone Primitive: Savage Intellectuals, Modern Lives*. Chicago, IL: University of Chicago Press.
- Traweek, S. (1988) *Beamtimes and Lifetimes: The World of High Energy Physicists*. Cambridge, MA: Harvard University Press.
- Trexler, R.C. (1995) *Sex and Conquest: Gendered Violence, Political Order, and the European Conquest of the Americas*. Ithaca, NY: Cornell University Press.
- Turner, B. (1978) *Marx and the End of Orientalism*. London: George Allen & Unwin.
- Wagner, R. (1981) *The Invention of Culture*. Chicago, IL: The University of Chicago Press.
- Withy, L. (1987) *Voyages of Discovery: Captain Cook and the Exploration of the Pacific*. Berkeley, CA: University of California Press.
- Yegenoglu, M. (1998) *Colonial Fantasies: Toward a Feminist Reading of Orientalism*, pp. 64–85. Cambridge: Cambridge University Press.

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