What's (not) in the mind of scientific agents?: Implicit psychological models and social theory in the social studies of science

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Abstract:

This essay connects different methods or approaches in the social studies of science (SSS) to models of the psychology of agents and to social theory. The methods considered include: Latour and Callon's actant formulation; Woolgar's analysis of rhetoric; Haraway's analysis of narrative; Marxism; Harry Collins' program in the Sociology of Scientific Knowledge, and cyborg anthropology. The SSS method-psychology-social theory connections I make are proposed in a heuristic spirit, not as tight propositions. That is, thinking about each of the three areas -- SSS method, psychology of agents, and social theory -- is animated by the attempt to draw connections to the other two. At the same time, because the resulting propositions will not refer to all the details of any particular SSS method, they are made in the expectation of provoking responses from the methods' proponents. Through these responses more of the diverse conceptual and practical resources that different SSSers employ might be revealed. I give more details about this model of agents as imaginative, heterogeneous constructors when I interpret this essay's method itself.

The essay aims to draw greater attention in SSS to three areas: 1) questions about the psychology of agents and about the structuredness of society, including the role of agents in the production and reproduction of this structuredness; 2) the different means by which a field can generate new concepts and questions; and 3) the heterogeneous constructionist model of distributed psychology and social causality, which constitutes an alternative to both contextual determination and autonomous agency.

Introduction

When describing how scientists secure support for their scientific theories, sociologist/anthropologists of science Latour and Callon (L&C) use the semiotic label actants for human, other living beings, and non-living things alike. The playfulness of the resulting anthropomorphic accounts seems to animate the discussion of the non-human resources, but in practice the accounts reduce everything to a lowest common denominator, dulling the analysis of human purposes, motivations, imagination and action. Beginning with L&C's work, this essay examines the implicit models of the psychology of scientists involved in various approaches to the social studies of science (SSS), including Woolgar's analysis of rhetoric, Haraway's analysis of narrative, Marxism, Harry Collins' approach to the Sociology of Scientific Knowledge, and cyborg anthropology. L&C's scientific agents, for example, act with a minimal psychology, almost without mental representations. This ensures that inborn dispositions, cognitive constraints, individual creativity, and so on, cannot determine action and belief, thus preempting those who invoke the internal cognizing mind to resist the social construction of science. Psychology of agents is, in turn, an arena in which to argue about social causality, about the structuredness of society and the role of agents in its production and reproduction. L&C's variant of behaviorism, for example, leaves no place for interests or other external influence to reside inside the scientist's head, and thus counters earlier analyses that allows social context or forces to determine their beliefs or actions.

This essay speaks also to a second theme, the different means by which a field can generate new concepts and questions. Consistent with the greater space I favor for conceptual or theoretical "exploration," I do not claim to establish tight connections of different SSS methods to models of the psychology of agents and to social theory. Instead, connections among the three areas are proposed in a heuristic spirit. That is, thinking about each of the three areas is animated by the attempt to draw connections to the other two (Figure 1). Questions are brought to light by noticing how the social theory associated with different SSS methods depends on crude causal relations concerning the effect of context or social structure/dness on agents and the role of agents in its re/production. At the same time, because the resulting propositions or *accusations* will not refer to all the details of any particular SSS method, they are made in the expectation of provoking responses from the methods' proponents. Through these responses more of the diverse conceptual and practical resources that different SSSers employ might be revealed. In short, the method introduced in this essay provides one entry point, resource, sensitizing perspective -- and many more are needed -- to probe and intervene in the networks which SSSers build. Perhaps, readers in other areas of the social sicences will extend this project to their own areas.

In the conclusion I combine the two themes by interpreting my own method in light of a model of agents as imaginative, heterogeneous constructors. This model of distributed psychology and social causality constitutes an alternative to both contextual determination and autonomous agency. Although I do not make the case here, I hope that these directions will prove productive of new social theory.

Actants and anthropomorphism

> On Christmas Eve of 1976 in the Bay of St. Brieuc in Brittany, deep down in the water thousands of scallops were brutally dredged by fishermen who could not resist the temptation of sacking the reserve oceanographers had put aside. French gastronomes are fond of scallops, especially at Christmas. Fishermen like scallops too, especially coralled ones, that allow them to earn a living similar to that of a university professor (six months' work and good pay). Starfish like scallops with equal greed, which is not to the liking of the others...

These are the words of Bruno Latour, in Science in Action (Latour 1987, p. 202). He continues:

> Three little scientists sent to the St. Brieuc Bay to create some knowledge about scallops love scallops, do not like starfish and have mixed feelings about fishermen. Threatened by their institution, their oceanographer colleagues who think they are silly and the fishermen who see them as a threat, the three little scientists are slowly pushed out of the Bay and sent back to their offices in Brest. Whom they should ally themselves with to resist being rendered useless? Ridiculed by scientists, in competition with starfish, standing between greedy consumers and new fishermen arriving constantly for dwindling stocks, knowing nothing of the animal they started to catch only recently, the fishermen are slowly put out of business. To whom should they turn to resist? Threatened by starfish and fishermen, ignored for years by oceanographers who do not even know if they are able to move or not, the animal is slowly disappearing from the Bay. Whom should the scallops' larvae tie themselves to so as to resist their enemies? (Latour 1987, p. 202-3)

> The situation Latour describes was first presented by his colleague, Michel Callon:

> The researchers place their nets but the collectors remain hopelessly empty. In principle the larvae anchor, in practice they refuse to enter the collectors. The difficult negotiations which were successful the first time fail in the following years.... The larvae detach themselves from the researchers' project and a crowd of other actors carry them away. The scallops become dissidents. The larvae which complied are betrayed by those they were thought to represent. (Callon 1985, 219-29).

Latour's and Callon's descriptions are clearly cases of anthropomorphism, that is, the same language is employed for fishermen, scientists, scallops. They are all agents, actors, or, the term Latour and Callon favor, actants. This equivalence is not just colorful language; it is a matter of method. Callon again:

> The observer must abandon all a priori distinctions between natural and social events. He must reject the hypothesis of a definite boundary which separates the two. These divisions are ... the result of analysis rather than its point of departure. ... Instead of imposing a pre-established grid ... the observer follows the actors in order to identify the manner in which these define and associate the different elements by which they build and explain their world, whether it be social or natural. (Callon 1985, 200-201).

In order to assess Latour and Callon's (L&C's) method of no a priori distinctions, of letting the actants show us the categories, I want to ask two sets of questions:

1. What does the method of say about the psychology of scientific agents? Does it constitute a new angle from which to appreciate agency? Are the resulting accounts good ones, corresponding well to agents we know?

2. What model or theory of society follows from, is implied by, or can be read out of accounts of agents having the psychology implied by L&C's method? How is society structured? What role do agents have in the production and reproduction of society's structures (or structuredness)?

In classical anthropomorphism the scientist explains the behavior of animals as if they had goals like humans (or, more generally, as if they feel, imagine, and think, that is, represent like humans) and behaved according to such cognition. The quotes I took from L&C were clearly anthropomorphic; animals, the scallops for example, act just as much as scientists act in the Bay of Brieuc. Two differences, however, or developments separate L&C from classical anthropomorphism:

a) the image of human cognition is reduced to humans having simple goals, specifically, to resist and to overcome resistance -- a form of simple agonistic behavior. For L&C, scientists use laboratories, technical artifacts, allies, and other resources to shift the world, working against its inertia and against others trying to shift the world in different directions; and

b) a terminological equivalence in the terms describing the actions of humans and animals; scallops "resist." To act, to be an agent, is to resist.

The terminological equivalence (item b) allows L&C to oppose other commentators on science who would have scientists (humans) be the only source of resistance. It also ensures consistency in a larger scheme, evident in subsequent texts, that extends beyond human and other living agents to include technological objects. That is, objects resist, so, if "act" is equated with "resist," objects can, like humans and scallops, be actors, agents, actants. Non-living, technological agency is important to L&C, as we shall see shortly, but let us dwell on their anthropomorphism for a moment.

An obvious objection to L&C's anthropomorphism is that SSS needs the scientists to reveal the animals' cognition, perhaps even to reveal their behavior (Collins and Yearley 1992, 312ff). This conceptual flaw might seem to be a big problem for the actant program; if it cannot be operationalized, its empirical adequacy can hardly be established. Significantly, the program has not, in practice, been carried out; we know nothing about scallops' cognition and little about their behavior after reading L&C's work.

Nevertheless, the actant terminology has become quite popular. The plausibility, then, of the actant-anthropomorphism must draw from elsewhere, namely, I suggest, from the power of the assumptions about human goals and cognition (item a) underwriting this approach. These assumptions, common in SSS, are best described as analogous to those of behaviorist psychology.

Behaviorism and social theory

Behaviorist psychology has always attempted to minimize the role of internal mental representations in explaining an organism's behavior. Provided only that the organism is internally motivated to satisfy its appetite, provision of food in experimental situations can reinforce the desired behavioral responses. (Equivalently, for negative reinforcement using electric shocks, the organism is a pain avoider.) Similarly, L&C's image of scientists building networks in response to the stimulus of others building competing networks reduces the psychology of cognitive agents to a bare minimum. All that they need to assume is that scientists seek to accumulate resources, resulting, if successful, in "centers of calculation," "obligatory passage points" (Callon 1985) and their becoming “macro-actors” (Callon and Latour 1981). Governed only by this egocentric metric of resource accumulation, these agents are not assumed to have any practical imagination about constraints and facilitations influencing their possible action, let alone about the possible structuredness of those constraints and facilitations.

L&C's scientists are, admittedly, more scheming than the pigeons as described by behaviorists; sometimes L&C's scientists sound almost Machiavellian. Nevertheless, on the explanatory (as against descriptive) level, the psychology of these scientists is minimal. It is as if a coach of an American football team commanded his players to move the ball up the field against the resistance of the opposing team and asked them to refer only to that objective. No anticipation of the co-ordinated responses of the other players, either on their own team or the opposing one, would be used by the players to decide on their moves. Such a team would, against most opponents, fail to score.

Behaviorism tends to be a dirty word; few social scientists or humanists admit to this disposition. Not surprisingly, when I made this accusation to Latour in person (pers. comm. April 1993) he countered that we should assume a minimal psychology to allow the agents to

show us how they think about the world, what they see as resources, and who they see as allies. Latour was claiming that minimal psychology is a methodological assumption, not his belief about actual agents. This distinction and rationalization, however, is of dubious value; it does not get at the heart of what is at stake here about how his approach to SSS leads us to think about agents.

Consider this question: What guidance does L&C's psychologically minimalist method give us about the forms agents' action can take? As a negative answer to this question, the "no mental representations" dictum ensures two things:

a) agents are not internally bound -- inborn dispositions, cognitive constraints, individual creativity, etc. cannot determine action and belief; and, more importantly,

b) agents are not Socially determined -- with nothing in the mind of scientists, there is no place for interests, determined by the agents' class (or other) position in the Social Structure, or for other external influences to reside. (Social Structure is capitalized here to denote a gross and relatively static view, something given while the science in question develops, e.g., "In Capitalist Societies...")

Given this absence of both internal and external constraint, it might seem then that anything goes, that every action is spontaneous and contingent. Latour (1994), however, pulls us back from such an extreme position. *Technical* mediations -- "interruptions", "translation", "black boxing", "delegation" -- commonly modify an agent's course of action. Not anything goes in love and war; not anything can be done in science, technology and society. (In fact, Latour would add that humans are not humans without technical mediations.) Notice, however, that the resistances are technical; there is no mention of sociological mediations, involving, say, ideology, socialization, or dominant metaphors.

Now we can see what is at stake in L&C's actant program: From every angle possible the idea of agents' actions being Socially determined must be opposed. Technical mediations are stressed precisely because they are not social mediations, and the minimal psychology of L&C's agents helps them resist Social determination. This suggests an alternative interpretation to L&C as behaviorist moles in the SSS ranks. Instead, we can see them as social theorists supporting a particular argument about relations between agents and society. They are telling us how agents' sociality influences their actions, and how society, in turn, is influenced by those actions. Let me tease out that interpretation.

L&C's method calls for us to describe the heterogeneous networks of resources and allies being mobilized by scientists in action as they resist other scientists in action. The psychology of these agonistic resource-accumulators is, as we have noted, minimal, and so their actions cannot be determined by Social Structures. However, the sociality of these agents is not minimal. L&C focus on their agents' contingent and on-going mobilizing of networks of

resources and allies, and this tends to keep causality distributed across networks, not concentrated inside socially autonomous agents. I say "tends," because L&C's individuals remain at the center of the networks. If the networks become strong, L&C want us to see the responsible agents as macro-actors, who were once micro-actors and are always vulnerable to becoming so again (Callon and Latour 1981).

As a program of social theory L&C's method has an unfortunate conceptual flaw. The resilience of at least some, if not most, of the strong networks will ensure their persistence for some period of time. It would be reasonable to view persistent networks as social structures (the small “s” used to distance the idea from the earlier gross and static image of structures). More subtly, any regularities in the opportunities and constraints agents experience as part of their sociality we could interpret as social structuredness. Pursuing this interpretation, we might ask how agents' actions generate, maintain, and undermine that structuredness. Indeed, the agents themselves might identify at least some of these structures and structuredness.

The issue of social determination that L&C had hoped to banish is thus resurrected, albeit in a *distributed* rather than direct form. L&C try to distract us from examining social structure/dness and its reproduction by moving their spotlight among diverse, unrelated cases of a rising or falling macro-actor, fact, or technology. Rather than follow them in action, however, let us stay with the unresolved issues around agency and structuredness in their social theory.

Method, psychology of agents, and social theory

The steps leading up to my interpretation of L&C as social theorists can be extended to theories and theorists in social studies of science more generally. Propositions about method, the implied psychology of the agents, and views about causality in social theory (in particular, about the two-way relation between agency and structure/dness) are mutually entailing. Given that method is usually more explicit than psychology and social theory are in SSS, we can start with method and, working from there, illuminate the other corners of the triad.

-- Insert Figure 1 about here --

Before employing this heuristic on other approaches in SSS, let me note two recurring tensions evident in L&C:

a) autonomy of agents vs. givenness of social structure ("A" vs. "S" in table 1): For L&C society is being made at the same time as science is (that is, on the same time scale). However, in avoiding any recourse to social givenness, to the regularities or structuredness of resources mobilizable by agents, L&C cannot help but convey an image of scientists as self-moving

movers. Thus, as we follow these agents in action, we can take their goals and rationality as given;

b) causality concentrated or reduced to micro-level vs. distributed or heterogeneous causality ("R" vs. "D" in table 1): Descriptions of heterogeneous networks work against any attempt to explain an outcome with one set of terms, those, say, of experimental testing, of negotiations with research sponsors, or of rhetorical strategies. At the same time, however, the image of agents as resource accumulators and L&C's accounts of micro-actors becoming macro-actors tends to concentrate causality in the individual agent. Indeed, L&C have not taken up the project of analyzing heterogenous resources as multiple, interacting, distributed causes (Taylor 1995a).

-- Insert Table 1 about here --

Woolgar

Steve Woolgar might seem harder to interpret as a social theorist than L&C were, because he does not talk about social theory. But this is not a mere omission; it is an opposition. Let me explain what follows from this.

In his 1981 critique of interests explanations in SSS Woolgar promotes a reduction of psychology analogous to L&C's. In opposition to an image of agents pursuing interests that correspond to their external circumstances, he describes agents who at first sight seem richly cognitive -- they anticipate, assess, and manage "possible conditions and consequences of action" (Woolgar 1981, p. 375). He advises us to interpret the rhetorical constructive work being done by the agents themselves (and also by us as interpreters) in making claims about interests as causes of scientific beliefs. In particular, given that interests imply a commonality among agents in some definable group, Woolgar asks us to notice how divergent ideas and actions are smoothed over and discounted.

Yet, we might ask of Woolgar, to what end are these agents doing this rhetorical management? The implicit rationality of his agents is that they seek to enroll and enlist others in order to generate support for, and defuse opposition to, their rhetorical construction of reality. Anything outside these agents that we (or they) might use to explain their beliefs and actions, such as interests born of class membership, is a rhetorical construction of commonality out of diversity, and is thus vulnerable to deconstruction. At what level of aggregation, however, does this deconstruction stop? In a Woolgarian spirit, we could deconstruct individuality, asking whether commonality of interests among different aspects of an individual's psychology is a also rhetorical construction. Woolgar does not; individuals are his base level. This avoidance of psychology ensures that there is nothing inside his agents that we (or they) might use to explain their beliefs and actions. Just like L&C's behaviorism, it is a strong, yet thin view of individual rationality that Woolgar promotes.

Woolgar does not explore the implications of his having individuals at the foundation in his accounts. Instead he evades the issue; like L&C, he constantly breaks his deconstructive camp and moves on to another case. Suppose we stop and take stock, however. Woolgar's individuals as foundations, when combined with his ethnomethodological emphasis on face-to-face negotiations, yields a strong view of social causality: Society is founded upon individual negotiators, and the negotiations are often dominated by master rhetoricians.

Woolgar's highlighting of the individual rhetorician-agents is not, however, a straightforward endorsement of the autonomous agent pole of the autonomy-social givenness tension identified earlier. Granted, Woolgar, again like L&C, maintains that society is constantly being made, so we should not, except in rhetoric vulnerable to Woolgarian deconstruction, invoke any social givenness. But such psychologically strong (yet thin) agents are necessary in Woolgar's own rhetorical construction of reality *only because there is some strong context* -- his agents need to be strong to get their own way. Indeed, the strength of the strongest, master rhetoricians, who Woolgar celebrates in his more recent work (Woolgar QQ), is one contributor to this strong context. In this dialectical fashion Woolgar's rhetoric privileges context, or, in my terms, social structuredness (see Table 1).

In fact, all the people and approaches that this essay reviews negotiate the structure-autonomous agency relation as a dialectic; they never reside at one pole only. Or, at least, I propose that we adopt this "fact" as a heuristic which will help us explore the three-way relations among SSS method, psychology of agents, and social theory.

Haraway

No one schema can do justice to the abundance of intertextualities and referents in Donna Haraway's work. Nevertheless, application of the preceding heuristic yields some interesting interpretations of -- or accusations about -- her interpretations, which employ playful caricatures and dualisms as well as skilful, contextually sensitive readings of scientific texts, artifacts, and research programs. In Haraway (1989) the scientists are story-tellers, agents with rich mental representations. The stories, however, are often subordinate to the dominant narrative themes or by defined in opposition to those themes. In both cases, the themes structure the stories and the social relations facilitated by those storiesQQ. This structuring, in turn, sustains those themes. From another angle, however, Haraway's favorite characters are those who are out there playfully negotiating change, rather than hiding or isolating themselves from it, characters such as the Sister Outsider, Inappropriate/d Other, Coyote Trickster, and FemaleMan, and the Cyborg (Haraway 1985, 1997). These characters seem mostly to exemplify autonomy. When we ask, however, about the motor behind this change, we find it is externally driven, in the form not of technological inevitability, but of inexorable

commodification. Once a market is created where there was not one before, more and more people's lives are transformed by production and exchange of the commodity; there is no going back. Because we cannot escape this, Haraway invites QQ to become more self-consciously implicated in the process. QQmarginal, dominated, silenced outsiders who move into areas previously off limits

But how are we to join in the market in ways that allow us to distinguish resistance from accommodation? While this question is not clearly answered in Haraway's complex accounts of "material-semiotic" production (Haraway 1988), the implicit theme of inexorable commodification recalls a Marxist economic determinism, which would direct resistors to the necessity of class struggle. Yet the call to class struggle assumes that many differences among agents can be subordinated in the cause of more effective struggle against or resistance to dominant economic structures.QQHere is the structure that motivates Haraway's depiction of her agents, a structure that might be read as a residual economistic Marxism. (Haraway may also be read, recalling Woolgar's analysis of rhetorical construction of interests explanation, as enlisting the allegiance of those who desire some solidarity and self esteem in their marginal position.)

Harvard patents a mouse that is transgenic, corporate and academic, natural and commodity, organic and technical--a cyborg (Haraway 1997). Some cyborgs warrant scrutiny, especially those originally designed for war-making. Other cyborgs provide a transformative standpoint; like their kin, the Sister Outsider, Inappropriate/d Other, Coyote Trickster, and FemaleMan©, they are the QQ [Recall also Traweek's Japanese woman high energy physicist in "When Eliza Doolittle studies." The kin listed here are borrowed and adapted by Haraway respectively from Audre Lorde, Trinh Minh-Ha, Native American myths, and Joanna Russ. See Donna J. Haraway, "Manifesto for cyborgs: Science, technology, and socialist feminism in the 1980s," Socialist Review 80 (1985): 65-107, "Promises of monsters," "Mice into wormholes." See also Edwards' essay on cyborgs in this collection and Gray, Cyborg Handbook.]. However, if Sister Outsiders provide special standpoints, why privilege situations in which they playfully, transgressingly negotiate change? Is transgression good? Why rule out havens or places of refuge, outside the dominant mess, in nurturing, organic communities? After all, Haraway's favoring of Sister Outsiders has helped enlist the allegiance of many who desire some solidarity and self-esteeem in their marginal positions.

We cannot find refuge in an organic unity for reasons that depend--at least, in my reading of Haraway--on inexorable commodification. [In "Promises of monsters" Haraway speaks of "relentless artifactualism." I read this as a combination of two themes: a) humans (and other

organisms, especially primates) are heterogeneous constructors; and b) commodification is inexorable.]

Haraway, Ross, Hess, and Traweek would not deny the limitations of class- or solidarity-based politics and are quite sensitive to the multiple dimensions of difference. Nevertheless, accounts that point to the existence of differences, ironies, transgressions, and other aspects of unruly complexity can still build on or build in complexity-collapsing concepts of politics.

Some other methods

Marxism has not QQor making objective & subjective assessment of possibilities for action **(D)**,

I leave the other method/psychology/social theory connections as they appear in table 1 (as they say in textbooks, as an "exercise for the reader").

QQKeller difficulties

Distributed Causality and Psychology

Suppose an interpreter, "X," decided to interpret this essay's approach of relating method to the psychology of agents and social theory. Following my examples, X might infer that the psychology of my agents, namely, SSS interpreters of science, must be that they seek an intellectual consistency. These agents make the three areas -- method, psychology of their agents, and social theory -- reinforce each other. Without this view of the SSSers' psychology, I could not use my approach of inferring one area from the others in order to fill in what is not stated. In turn, a theory about the relationship of agency to social structuredness could be inferred by X from my proposition that SSS methods can be interpreted in terms of the interpreters' unacknowledged views about their agents and society. This theory says that we should not take interpreters at face value, that we have to go beyond their stated accounts of their own methods in order to explain what they are doing. In short, there are considerations that they are taking-for-granted and incorporating implicitly into their concepts and practices.

These are broad brush connections. In order to get beyond them, recall that, in a heuristic spirit, I intended connections, such as those of X, to serve as accusations, to which the method's proponent might respond. My response, then, is that agents with a psychology of seeking intellectual consistency are more directional than I intend. I want a more complicated account of agents, of scientists and interpreters alike, that still permits us to relate method to psychology and social theory.

The agents of the SSS that I envisage act by mobilizing a variety of resources, resources as *heterogeneous* as equipment, experimental protocols, citations, the support of colleagues, the reputations of laboratories, metaphors, rhetorical devices, expository and pictorial conventions, publicity, funding, and so on. The outcomes of scientific and interpretive work, which include theories, technologies, readings from instruments, collaborations, a person's reputation, and so on, are accepted because the networks of linked resources make the outcomes difficult to modify in practice. This matches the actor-network approach of Latour/Callon, Law and others (Latour 1987, Law 1987), but I have my own qualifications:

•humans, non-human organisms and non-living resources are not interchangeable variants within the one category, actants;

•some resources are taken for granted and not spoken about literally (an anti-empiricist position);

•resources may be stable or regular on some time scale and spatial scale; and

•practice refers to social practices more broadly than the handling of material artifacts and textual or rhetorical exchanges (Taylor 1992).

According to this extension of actor-network theory, all outcomes are *heterogeneous constructions* (Taylor 1995a), a perspective has further implications for my views about the psychology of agents, method and social theory, and about their interrelatedness.

I advocate building theory and explanations concerning agents upon an image of their being *imaginative* heterogeneous constructors. By imaginative I mean that agents project themselves into possible engagements with the world in order to assess, although not necessarily explicitly, the practical constraints and facilitations of possible actions in advance of their acting (Taylor 1995a). If we focus on their contingent and on-going mobilizing of networks of resources and allies, we can keep psychology distributed, not concentrated mentally inside socially autonomous agents. That is, although agents work with mental representations of their worlds, the malleability of those representations should not be understood merely in internal mentalistic terms related to changing belief or rationality. Instead, we should ask what facilitates agents *acting as if* the world were like their representations of it.

Imaginative agents with distributed psychologies cannot be rational calculators of the implications of social factors for their actions. Nor can they be determined by social factors, a situation I see as a limiting case of rationality. These possibilities are ruled out by the heterogeneity of resources that these agents link together tending to form an *unruly complexity*, in which boundaries and categories are problematic, levels and scales are often not clearly separable, structures are subject to restructuring, and control or generalization are difficult. Rationality and external social determination are appearances that agents construct by reducing the complexity through linguistic discourse and through engineering. Such discursive or

engineering work facilitates agents acting as if the world were composed of *systems*, that is, of natural units having clearly defined boundaries, coherent, internally-driven dynamics, and simply mediated relations with the system's external context. *System-izing* is, however, counteracted by agents varying their discursive reductions from context to context and by engineered systems always having unintended effects. Therefore, when agents employ discursive and material systems as resources, further complexity is added to their on-going network building. In short, social structures are something whose apparent persistence is to be explained (Wolf 1982), not assumed as a cause or goal determining agents' rational actions.

Anyone interpreting scientific and social processes as heterogeneous construction faces the challenge of analyzing and representing which of the diverse resources mobilized make a difference and how those resources are combined to do so (Taylor 1992, 1995a). It would hardly be consistent, therefore, if I conceived of my method as a way to identify systems of only three mutually determining variables: SSS method, psychology of agents, and social theory. It is more consistent for me to insist that the resulting interpretations be advanced in a heuristic spirit. Recall that I intend such interpretations, as accusations, to provoke responses from the proponents of the different methods. My response, for example, has revealed, if not the diverse practical resources that I am employing, at least some of the intellectual strands that support this essay's method. As I stated earlier, this method provides one entry point or resource -- and many more are needed -- to probe and intervene in the networks which SSSers build.

If we interpret SSS interpreters as heterogeneous constructors, we should expect that they will select and juxtapose components in narratives, fashion boundaries and categories, employ familiar conventions of representation, and so on, in order to convince intended audiences, secure ongoing support from colleagues, collaborators, and institutions, and enlist others to act on their interpretations -- or, more broadly, to stimulate others to build networks that reinforce their own interpreting. It would seem both consistent and of good practical sense for different interpreters to reflect on the range of practical conditions that enable them to build and gain support for their own interpretations of scientific activity (but see Fish 1989). In that spirit I might, for example, notice that many SSSers in my potential audience demand empirical case studies before entertaining a new approach. I might then plan my research and manuscripts submitted for publication accordingly.

Yet, consistency, as inferred by X and as invoked in the previous two paragraphs, cannot simply direct an agent's actions. One of the resources drawn on by SSS interpreters is a long standing convention in scholarly writing to highlight the conceptual equipment employed in interpreting; writers rarely show evidence of systematic practical reflexivity. Indeed, my response to the accusation I wrote for X has not led me to expose to the reader, let alone to system-ize, my efforts to build networks that would advance the method introduced here

(Taylor 1995b). On the other hand, this omission is consistent with the essay's emphasis not on all-encompassing reconstructions, but on heuristics. Making sense/SSS out of these in/consistencies is material for further work.

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Table 1: PSYCHOLOGY OF AGENTS IN RELATION TO SOCIAL STRUCTURE/DNESS

	METHOD	PSYCHOLOGY OF AGENTS	STRUCTURE/DNESS AND AGENCY
Latour & Callon	Describe heterogeneous networks of resources & allies **(D)**	Resource-accumulators **(R)**	Strong vs. weak networks **(D)**, centered around individuals **(A)**, i.e., macro- vs. micro-actors **(R)**
Woolgar	All is rhetoric **(R)** invoked in face-to-face production **(A)**	Rhetorical enrollers **(R)** & managers **(D)**	Structuredness discounted as rhetoric, but implicitly present, building on individual negotiators **(D)** or shaped by master rhetoricians **(R)**
Haraway (1989)	Skilful reading; contextually sensitive cross-connecting **(D)**; playful caricatures, using dualisms **(R)**	Story-tellers **(A)** who draw on available narrative themes -- dominant **(S)**, ascendant **(S/A)**, oppositional **(S/A)**	Use of themes structures social relations & sustains those themes **(D)**. Dominant and ascendant themes are resisted by Sister Outsider, Coyote Trickster & Cyborg **(A)**, who are subordinate to implicit inexorability of commodification **(S)**
Marxist	Study scientific developments in terms of conflicts over access to & control of conditions of production **(S)**	Having interests **(R)**, they tend to act and form alliances **(A)** in accordance with their class position **(S)**	Control over conditions of production, e.g., labor & material resources, shapes or constrains **(S)** agents' subjectivity, which is evident in their interests
Collins' Sociology of Scientific Knowledge	Even-handed micro-observations of debates (little to say about causes of closure)	*Either* not spoken about because psychology constrains interpretive flexibility **(A)**, *or* attributed to forms of life **(R)** --agents operating within these know what is known and what remains interpretively flexible	Indefinite interpretive flexibility **(A)** and/or micro-negotiations **(R)** lie behind any macro structure there is.
Cyborg anthropologist (including Haraway 1997)	Recount narratives of technical practices, including ascriptions of agency to technologies **(A)**, especially in cultures marginalized by the dominant scientific culture **(S)**	Makers of meaning and identity **(A)**, yet whose subjectivity depends on internalizing **(R)** discursively avaliable meanings and identities **(D)**.	The growing, complex, diverse/ plural, interconnected **(D)** world system of power & control **(S)** is strategically produced by non-autonomous individuals, machines, & information technologies **(A)**