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Notes on the Theory of the Actor Network: Ordering, Strategy and Heterogeneity

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Introduction

Just occasionally we find ourselves watching on the sidelines as an order comes crashing down. Organisations or systems which we had always taken for granted -- the Union of Soviet Socialist Republics, or Continental Illinois -- are swallowed up. Commissars, moguls and captains of industry disappear from view. These dangerous moments offer more than political promise. For when the hidden trapdoors of the social spring open we suddenly learn that the masters of the universe may also have feet of clay.

How is it that it ever seemed otherwise? How is that, at least for a time, they made themselves different from us? By what organisational means did they keep themselves in place and overcome the resistances that would have brought them tumbling down much sooner? How was it we colluded in this? These are some of the key questions of social science. And they are the questions that lie at the heart of "actor-network theory"(1) -- the approach to sociology that is the topic of this note. This theory -- also known as the sociology of translation -- is concerned with the mechanics of power. It suggests, in effect, that we should analyse the great in exactly the same way that we would anyone else. Of course, this is not to deny that the nabobs of this world are powerful. They certainly are. But it is to suggest that they are no different in kind sociologically to the wretched of the earth.



Here is the argument. If we want to understand the mechanics of power and organisation it is important not to start out assuming whatever we wish to explain. For instance, it is a good idea not to take it for granted that there is a macrosocial system on the one hand, and bits and pieces of derivative microsocial detail on the other. If we do this we close off most of the interesting questions about the origins of power and organisation. Instead we should start with a clean slate. For instance, we might start with interaction and assume that interaction is all that there is. Then we might ask how some kinds of interactions more or less succeed in stabilising and reproducing themselves: how it is that they overcome resistance and seem to become "macrosocial"; how it is that they seem to generate the effects such power, fame, size, scope or organisation with which we are all familiar. This, then, is the one of the core assumptions of actor-network theory: that Napoleons are no different in kind to small-time hustlers, and IBMs to whelk-stalls. And if they are larger, then we should be studying how this comes about -- how, in other words, size, power or organisation are generated.

In this note I start by exploring the metaphor of heterogeneous network. This lies at the heart of actor-network theory, and is a way of suggesting that society, organisations, agents and machines are all effects generated in patterned networks of diverse (not simply human) materials. Next I consider network consolidation, and in particular how it is that networks may come to look like single point actors: how it is, in other words, we are sometimes able to talk of "the British Government" rather than all the bits and pieces that make it up. I then examine the character of network ordering and argue that this is better seen as a verb -- a somewhat uncertain process of overcoming resistance -- rather than as the *fait accompli* of a noun. Finally, I discuss the materials and strategies of network ordering, and describe some organisationally-relevant findings of actor-network theory. In particular, I consider some of the ways in which patterning generates institutional and organisational effects, including hierarchy and power.

Society as Heterogeneous Network

Actor-network authors started out in the sociology of science and technology. With others in the sociology of science, they argued that knowledge is a social product rather than something generated by through the operation of a privileged scientific method. And, in particular, they argued that "knowledge" (but they generalise from knowledge to agents, social institutions, machines and organisations) may be seen as a product or an effect of a network of heterogeneous materials.

I put "knowledge" in inverted commas because it always takes material forms. It comes as talk, or conference presentations. Or it appears in papers, preprints or patents. Or again, it appears in the form of skills embodied in scientists and technicians (Latour and Woolgar, 1979). "Knowledge", then, is embodied in a variety of material forms. But where does it come from? The actor-network answer is that it is the end product of a lot of hard work in which heterogeneous bits and pieces -- test tubes, reagents, organisms, skilled hands, scanning electron microscopes, radiation monitors, other scientists, articles, computer terminals, and all the rest -- that would like to make off on their own are juxtaposed into a patterned network which overcomes their resistance. In short, it is a material matter but also a matter of organising and ordering those materials. So this is the actor-network diagnosis of science: that it is a process of "heterogeneous engineering" in which bits and pieces from the social, the technical, the conceptual and the textual are fitted together, and so converted (or "translated") into a set of equally heterogeneous scientific products.

So much for science. But I have already suggested that science isn't very special. Thus what is true for science is also said to be true for other institutions. Accordingly, the family, the organisation, computing systems, the economy and technologies -- all of social life -- may be similarly pictured. All of these are ordered networks of heterogeneous materials whose resistance has been overcome. This, then, is the crucial analytical move made by actor-network writers: the suggestion that the social is nothing other than patterned networks of heterogeneous materials.

This is a radical claim because it says that these networks are composed not only of people, but also of machines, animals, texts, money, architectures -- any material that you care to mention. So the argument is that the stuff of the social isn't simply human. It is all these other



materials too. Indeed, the argument is that we wouldn't have a society at all if it weren't for the heterogeneity of the networks of the social. So in this view the task of sociology is to characterise these networks in their heterogeneity, and explore how it is that they come to be patterned to generate effects like organisations, inequality and power.

Look at the material world in this way. It isn't simply that we eat, find shelter in our houses, and produce objects with machines. It is also that almost all of our interactions with other people are mediated through objects of one kind or another. For instance, I speak to you through a text, even though we will probably never meet. And to do that, I am tapping away at a computer keyboard. At any rate, our communication with one another is mediated by a network of objects -- the computer, the paper, the printing press. And it is also mediated by networks of objects-and-people, such as the postal system. The argument is that these various networks participate in the social. They shape it. In some measure they help to overcome your reluctance to read my text. And (most crucially) they are necessary to the social relationship between author and reader.

Here is a second example. I am standing on a stage. The students face me, behind several ranks of desks, with paper and pens. They are writing notes. They can see me, and they can hear me. But they can also see the transparencies that I put in the overhead projector. So the projector, like the shape of the room, participates in the shaping of our interaction. It mediates our communication and it does this asymmetrically, amplifying what I say without giving students much of a chance to answer back (Thompson :1990). In another world it might, of course, be different. The students might storm the podium and take control of the overhead projector. Or they might, as they do if I lecture badly, simply ignore me. But they don't, and while they don't the projector participates in our social relations: it helps to define the lecturer-student relationship. It is a part of the social. It operates on them to influence the way in which they act.

Perhaps it is only in lovemaking that there is interaction between unmediated human bodies -- though even here the extra-somatic usually plays a role too. But the general case, and the one pressed by actor-network theory, is this. If human beings form a social network it is not because they interact with other human beings. It is because they interact with human beings and endless other materials too. And, just as human beings have their preferences -- they prefer to interact in certain ways rather than in others -- so too do the other materials that make up the heterogeneous networks of the social. Machines, architectures, clothes, texts -- all contribute to the patterning of the social. And -- this is my point -- if these materials were to disappear then so too would what we sometimes call the social order. Actor-network theory says, then, that order is an effect generated by heterogeneous means.

At this point there is a parting of the ways. For the argument about the material patterning of the social can be treated in a reductionist manner. The reductionist versions tell that either machines or human relations are determinate in the last instance: that one drives the other (2). However, though these reductionisms are different, they have two things in common. First, they divide the human and the technical into two separate heaps. And second, they assume that one drives the other.

Actor-network theory does not accept this reductionism. It says that there is no reason to assume, a priori, that either objects or people in general determine the character of social change or stability. To be sure, in particular cases, social relations may shape machines, or machine relations shape their social counterparts. But this is an empirical question, and usually matters are more complex. So, to use Langdon Winner's (1980) phrase, artefacts may, indeed, have politics. But the character of those politics, how determinate they are, and whether it is possible to tease people and machines apart in the first instance -- these are all contingent questions.

Agency as Network

Let me be clear. Actor-network theory is analytically radical in part because it treads on a set of ethical, epistemological and ontological toes. In particular, it does not celebrate the idea that there is a difference in kind between people on the one hand, and objects on the other. It denies that people are necessarily special. Indeed it raises a basic question about what we mean when we talk of people. Necessarily then, it sets the alarm bells of ethical and



epistemological humanism ringing. What should we make of this? A clarificatory point, and then an argument.

The clarificatory point is this. We need, I think, to distinguish between ethics and sociology. The one may -- indeed should -- inform the other, but they are not identical. To say that there is no fundamental difference between people and objects is an analytical stance, not an ethical position. And to say this does not mean that we have to treat the people in our lives as machines. We don't have to deny them the rights, duties, or responsibilities that we usually accord to people. Indeed, we might use it to sharpen ethical questions about the special character of the human effect -- as, for instance, in difficult cases such as life maintained by virtue of the technologies of intensive care.

Now the analytical point. This can be made in several ways. For instance, I could argue (as have sociologists such as Steve Woolgar (1992) and psychologists of technology like Sherry Turkle, 1984) that the dividing line between people and machines (and for that matter animals) is subject to negotiation and changes. Thus it is easily shown that machines (and animals) gain and lose attributes such as independence, intelligence and personal responsibility. And, conversely, that people take on and lose the attributes of machines and animals.

However, I will press the argument in another way by saying that, analytically, what counts as a person is an effect generated by a network of heterogeneous, interacting, materials. This is much the same argument as the one that I have already made about both scientific knowledge and the social world as a whole. But converted into a claim about humans it says that people are who they are because they are a patterned network of heterogeneous materials. If you took away my computer, my colleagues, my office, my books, my desk, my telephone I wouldn't be a sociologist writing papers, delivering lectures, and producing "knowledge". I'd be something quite other -- and the same is true for all of us. So the analytical question is this. Is an agent an agent primarily because he or she inhabits a body that carries knowledges, skills, values, and all the rest? Or is an agent an agent because he or she inhabits a set of elements (including, of course, a body) that stretches out into the network of materials, somatic and otherwise, that surrounds each body?

Erving Goffman's (1968) answer is that props are important, but the moral career of the mental patient is not reducible to the props. Actor-network theory, like symbolic interaction (Star, 1990a; 1992) offers a similar response. It doesn't deny that human beings usually have to do with bodies (but what of Banquo's ghost, or the shadow of Karl Marx?) Neither does it deny that human beings, like the patients in the asylums described by Goffman, have an inner life. But it insists that social agents are never located in bodies and bodies alone, but rather that an actor is a patterned network of heterogeneous relations, or an effect produced by such a network. The argument is that thinking, acting, writing, loving, earning -- all the attributes that we normally ascribe to human beings, are generated in networks that pass through and ramify both within and beyond the body. Hence the term, actor-network -- an actor is also, always, a network.

The argument can easily be generalised. For instance, a machine is also a heterogeneous network -- a set of roles played by technical materials but also by such human components as operators, users and repair-persons. So, too, is a text. All of these are networks which participate in the social. And the same is true for organisations and institutions: these are more or less precariously patterned roles played by people, machines, texts, buildings, all of which may offer resistance.

Punctualisation and Resourcing

Why is it that we are sometimes but only sometimes aware of the networks that lie behind and make up an actor, an object or an institution? For instance, for most of us most of the time a television is a single and coherent object with relatively few apparent parts. On the other hand when it breaks down, for that same user -- and still more for the repair person -- it rapidly turns into a network of electronic components and human interventions. Again, for the average small businessperson, the BCCI was a coherent and organised location for depositing and withdrawing money. Now, however -- and even more so for the fraud investigators -- it is a complex network of questionable -- indeed criminal -- transactions. And



again, for the healthy person, most of the workings of the body are concealed, even from them. By contrast, for someone who is ill and even more so for the physician, the body is converted into a complex network of processes, and a set of human, technical and pharmaceutical interventions.

Why is it that the networks which make up the actor come to be deleted, or concealed from view? And why is this sometimes not the case? Let me start with tautology. Each of the above examples suggests that the appearance of unity, and the disappearance of network, has to do with simplification. The argument runs like this. All phenomena are the effect or the product of heterogeneous networks. But in practice we do not cope with endless network ramification. Indeed, much of the time we are not even in a position to detect network complexities. So what is happening? The answer is that if a network acts as a single block, then it disappears, to be replaced by the action itself and the seemingly simple author of that action. At the same time, the way in which the effect is generated is also effaced: for the time being it is neither visible, nor relevant. So it is that something much simpler -- a working television, a well-managed bank or a healthy body -- comes, for a time, to mask the networks that produce it.

Actor network theorists sometimes talk of such precarious simplificatory effects as punctualisations, and they certainly index an important feature of the networks of the social. Thus, I noted earlier that I refuse an analytical distinction between the macro and the microsocial. On the other hand I also noted that some network patterns run wide and deep -- that they are much more generally performed than others. Here is the connection: network patterns that are widely performed are often those that can be punctualised. This is because they are network packages -- routines -- that can, if precariously, be more or less taken for granted in the process of heterogeneous engineering. In other words, they can be counted as resources, resources which may come in a variety of forms: agents, devices, texts, relatively standardised sets of organisational relations, social technologies, boundary protocols, organisational forms -- any or all of these. Note that the heterogeneous engineer cannot be certain that any will work as predicted. Punctualisation is always precarious, it faces resistance, and may degenerate into a failing network. On the other hand, punctualised resources offer a way of drawing quickly on the networks of the social without having to deal with endless complexity. And, to the extent that they are embodied in such ordering efforts they are then performed, reproduced in and ramify through the networks of the social(3).

Translation: Social Ordering as Precarious Process

I have insisted that punctualisation is a process or an effect, rather something that can be achieved once and for all. Thus, actor-network theory assumes that social structure is not a noun but a verb. Structure is not free-standing, like scaffolding on a building-site, but a site of struggle, a relational effect that recursively generates and reproduces itself (4). The insistence on process has a number of implications. It means, for instance, that no version of the social order, no organisation, and no agent, is ever complete, autonomous, and final. Or, to put it another way, it means that notwithstanding the dreams of dictators and normative sociologists, there is no such thing as "the social order" with a single centre, or a single set of stable relations. Rather, there are orders, in the plural. And, of course, there are resistances.

Caution is required here, for the theory is not pluralist in the usual sense of the term. It doesn't say there are many more or less equal centres of power or order. What it says is that the effects of power are generated in a relational and distributed manner, and nothing is ever sown up. And that, to use the language of classical sociology, ordering (and its effects including power) is contestable and often contested. Thus I said earlier that human beings and machines have their own preferences. This was an informal way of talking of resistance and the polyvalent character of ordering -- of the way in which any particular effort at ordering encounters its limits, and struggles to accept or overcome those limits. Another way of saying this is to note that the bits and pieces assembled pro tem into an order are constantly liable to break down, or make off on their own. Thus analysis of ordering struggle is central to actor-network theory. The object is to explore and describe local processes of patterning, social orchestration, ordering and resistance. In short, it is to explore the process that is often called translation which generates ordering effects such as devices, agents, institutions, or organisations. So "translation" is a verb which implies transformation and the possibility of



equivalence, the possibility that one thing (for example an actor) may stand for another (for instance a network).

This, then, is the core of the actor-network approach: a concern with how actors and organisations mobilise, juxtapose and hold together the bits and pieces out of which they are composed; how they are sometimes able to prevent those bits and pieces from following their own inclinations and making off; and how they manage, as a result, to conceal for a time the process of translation itself and so turn a network from a heterogeneous set of bits and pieces each with its own inclinations, into something that passes as a punctualised actor.

The Strategies of Translation

How is the work of all the networks that make up the punctualised actor borrowed, bent, displaced, distorted, rebuilt, reshaped, stolen, profited from and/or misrepresented to generate the effects of agency, organisation and power? How are the resistances overcome? Here actor-network theory engages with the question that I posed at the outset: how is it that we never saw before that the Gorbachevs of this world really had feet of clay all along. For actor-network theory is all about power -- power as a (concealed or misrepresented) effect, rather than power as a set of causes. Here it is close to Foucault (1979), but it is not simply Foucauldian for, eschewing the synchronic, it tells empirical stories about processes of translation. Indeed, there is more than a hint of Machiavelli in the method, and the author of *The Prince* is cited approvingly by several actor-network theorists for his merciless analysis of the tactics and strategies of power.

But what can we say about translation and the methods of overcoming resistance? Actor-network theory almost always approaches its tasks empirically, and this is no exception. So the empirical conclusion is that translation is contingent, local and variable. However, four more general findings emerge:

(1) The first has to do with the fact that some materials are more durable than others and so maintain their relational patterns for longer. Imagine a continuum. Thoughts are cheap but they don't last long, and speech lasts very little longer. But when we start to perform relations -- and in particular when we embody them in inanimate materials such as texts and buildings -- they may last longer. Thus a good ordering strategy is to embody a set of relations in durable materials. Consequently, a relatively stable network is one embodied in and performed by a range of durable materials.

The argument is attractive, but it is not as simple as it may seem. This is because durability is yet another relational effect, not something given in the nature of things. If materials behave in durable ways then this too is an interactional effect. Walls may resist the escape attempts of prisoners -- but only while there are also prison guards. Another way of putting it is that durable material forms may find other uses: their effects change when they are located in new networks of relations. In sum the argument about durability is attractive and has much merit -- but it needs to be handled with caution.

(2) If durability is about ordering through time, then mobility is about ordering through space. In particular, it is about ways of acting at a distance. Thus centres and peripheries are effects too, effects generated by surveillance and control. The affinity with Foucault is obvious, but actor-network theory approaches the matter somewhat differently. In particular, it explores materials and processes of communication -- writing, electronic communication, methods of representation, banking systems, and such apparent mundanities as early-modern trade routes. In other words, it explores the translations that create the possibility of transmitting of what Bruno Latour calls immutable mobiles -- letters of credit, military orders, or cannon balls. Once again the stress is on precarious relational effects -- though with a strongly historical emphasis, in part influenced by the "system-building" studies of such historians of technology as Thomas Hughes (1983), and in part by the Annales school of materialist history with its insistence on the "longue duree" (Braudel, 1975).

(3) Translation is more effective if it anticipates the responses and reactions of the materials to be translated. This idea is not new -- it is, for instance, crucial to Machiavellian political science, and counts as a central theme in business history (Chandler, 1977; Beniger, 1986) -- though actor-network writers resist the functionalism and technological determinism which



tends to characterise the latter. Instead, they treat what Bruno Latour calls centres of translation as relational effects and explore the conditions and materials that generate these effects and contain the resistance that would dissolve them. Drawing on the work of historians (e.g. Ivins, 1975, Eisenstein, 1980) and anthropologists (Goody, 1977; Ong, 1982), they thus consider the relationship between literacy, bureaucracy, print, the development of double-entry book-keeping, and newer electronic technologies on the one hand, and the capacity to foresee outcomes on the other. The argument is that under the appropriate relational circumstances such innovations have important calculational consequences, which in turn increases network robustness.

Note, again, the caveat about relational circumstances. As Weber well understood, calculation is not a *deus ex machina*. It is a set of social methods or relations in its own right. Furthermore, it can only work on material representations -- the products of surveillance which are also relational effects. Thus as I have indicated, systems of representation -- of immutable mobiles -- are also precarious. The analogy with the problem of political representation is direct, for as with any other form of translation, representation is fallible, and it cannot be foretold whether a representative will successfully speak for (and so mask) what it claims to represent.

(4) Finally there is the issue of the scope of ordering. I have been pressing the view that this is local. But, arguably it is possible to impute somewhat general strategies of translation to networks, strategies which, like Foucauldian discourses, ramify through and reproduce themselves in a range of network instances or locations. Note that if these exist they are more or less implicit -- for explicit strategic calculation is only possible if there is already a centre of translation (5).

What might such strategies look like? This, again, is an empirical matter. But since no ordering is ever complete, we might expect a series of strategies to coexist and interact. This, at any rate, is the claim made by several actor-network writers. Thus in a recent study of management I have detected a range of strategies -- "enterprise", "administration", "vocation" and "vision" -- which collectively operate to generate multi-strategic agents, organisational arrangements and inter-organisational transactions. Indeed, the argument is that an organisation may be seen as a set of such strategies which operate to generate complex configurations of network durability, spatial mobility, systems of representation and calculability -- configurations which have the effect of generating the centre/periphery asymmetries and hierarchies characteristic of most formal organisations.

Conclusion

In this note I have described actor-network theory and suggested that this is a relational and process-oriented sociology that treats agents, organisations, and devices as interactive effects. I have touched on some of the ways in which such effects are generated, and emphasised their heterogeneity, their uncertainty, and their contested character. In particular, I have argued that social structure is better treated as a verb than as a noun.

As is obvious, the approach has a number of points in common with other sociologies. However, its relational materialism is quite distinctive. To be sure, materialism is not new to sociology. Nevertheless, materialism and social relations have not always been the happiest of bedfellows. In the best sociologies such as Marxism and feminism they have interacted. Even so, it has been usual to treat them as if they were naturally different in kind, as a dualism rather than a continuity. However, as the dualisms fall in sociology, the actor-network approach joins the party in a radical spirit, for it not only effaces the analytical divisions between agency and structure, and the macro- and the micro-social, but it also asks us to treat different materials -- people, machines, "ideas" and all the rest -- as interactional effects rather than primitive causes. The actor-network approach is thus a theory of agency, a theory of knowledge, and a theory of machines. And, more importantly, it says that we should be exploring social effects, whatever their material form, if we want to answer the "how" questions about structure, power and organisation. This is the basic argument: to the extent that "society" recursively reproduces itself it does so because it is materially heterogeneous. And sociologies that do not take machines and architectures as seriously as they do people will never solve the problem of reproduction.



What does actor-network theory have to say to the sociology of organisations? One answer is that it defines a set of questions for exploring the precarious mechanics of organisation. I have implied above that these questions come in several forms. Thus it is convenient to distinguish, on the one hand, between questions to do with the materials of organisation, and on the other, with those to do with the strategy of organisation. So when actor-network theory explores the character of organisation, it treats this as an effect or a consequence -- the effect of interaction between materials and strategies of organisation.

These, then, are the kinds of questions it asks of organisations, and the powerful who head those organisations. What are the kinds of heterogeneous bits and pieces created or mobilised and juxtaposed to generate organisational effects? How are they juxtaposed? How are resistances overcome? How is it (if at all) that the material durability and transportability necessary to the organisational patterning of social relations is achieved? What are the strategies being performed throughout the networks of the social as a part of this? How far do they spread? How widely are they performed? How do they interact? How is it (if at all) that organisational calculation is attempted? How (if at all) are the results of that calculation translated into action? How is it (if at all) that the heterogeneous bits and pieces that make up organisation generate an asymmetrical relationship between periphery and centre? How is it, in other words, that a centre may come to speak for and profit from, the efforts of what has been turned into a periphery? How is it that a manager manages?

Looked at in this way organisation is an achievement, a process, a consequence, a set of resistances overcome, a precarious effect. Its components -- the hierarchies, organisational arrangements, power relations, and flows of information -- are the uncertain consequences of the ordering of heterogeneous materials. So it is that actor-network theory analyses and demystifies. It demystifies the power of the powerful. It says that, in the last instance, there is no difference in kind, no great divide, between the powerful and the wretched. But then it says that there is no such thing as the last instance. And since there is no last instance, in practice there are real differences between the powerful and the wretched, differences in the methods and materials that they deploy to generate themselves. Our task is to study these materials and methods, to understand how they realise themselves, and to note that it could and often should be otherwise.

Acknowledgements

I did not want to clutter the text, so I have included few references to actor-network theory in the body of this note. (Citations will be found in footnote 1.) However, the note reports on a large body of (substantially empirical) work by a series of authors. I am grateful to them all for their support over a decade.

Notes

1. This is the product of a group of sociologists associated with, and in several cases located at, the Centre de Sociologie de l'Innovation of the Ecole Nationale Supérieure des Mines de Paris. The authors associated with this approach include Madeleine Akrich (1989a; 1989b; 1992), Geof Bowker (1988; 1992), Michel Callon (1980; 1986*; 1987; 1991; and Latour, 1981; and Law and Rip, 1986), Alberto Cambrosio (et.al., 1990), Antoine Hennion (1985; 1989; 1990; and Meadel, 1986; 1989), Bruno Latour (1985*; 1986; 1987*; 1988a; 1988b; 1990*; 1991a; 1991b; 1992a; 1992b), John Law (1986a*; 1986b; 1987; 1991a; 1991b; 1992a; 1992b; and Bijker, 1992; and Callon, 1988*, 1992), Cecile Medeal (see Hennion and Medeal) Arie Rip (1986), and Susan Leigh Star (1990b; 1991*; this volume; and Griesemer, 1989). Those items marked with an asterisk might be particularly helpful for those not familiar with the approach.

2. Machine reductionism is current in the technological determinism of sociotechnical organisational theory. Human reductionism is current in many sociologies -- for instance in labour-process theory.

3. This is one of the places where actor-network theory maps onto the sociology of organisations: the affinity between this argument and the theory of institutional isomorphism is evident.



4. In this respect it is similar to several other contemporary social theories. Think, for instance, of Giddens' (1984) notion of "structuration", Elias' (1978) theory of "figuration", or Bourdieu's (1989) concept of "habitus".

5. This concern with implicit strategy is again consistent with Foucauldian sociology. See, for instance Foucault: 1981: 94-5.

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