

Pål Næsje

Explanatory Models in STS

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The lecture I've been asked to give is a lecture on a set of different theorists relating to--or which I've related to--the traditions within the science and technology studies field. First of all, the theorists whom I've been using in my doctoral dissertation (Næsje 2000), differ quite a lot. I would like to start out by making one observation about this. The application of an eclectic set of theories (or theorists), it seems to me, is more the rule than the exception in the case-oriented STS. Of course, scholars have a "favourite" theory--say Merton or Mannheim, Habermas or Foucault--but when digging into cases, a more pragmatic approach quickly evolves.

There could be several reasons for this. Within sociological theory, the impact of postmodernism is fading, but the "the death of the grand or master narratives" are one adage that seems to have a lasting impact. Thus, few scholars believe that one grand theory is able to explain social phenomena in full. What has been called "The textual turn" is another factor that is slowly seeping into disciplinary sociology generally, and STS more specifically. In STS, it seems to me, the textual turn implies a new level of analysis, of coming on top of or adjacent to already existing modes of explanation. So, a more eclectic and explorative approach to the selection of theories for the explanation of social phenomena seems to be developing.

Moreover, when discussing the topic given, I'll turn to some of these general insights to new theories for ordering the theories I've used in my dissertation work. Essentially, what I've been asked to do is to discuss the ordering principles in my dissertation: What I will propose here is that it will be possible to introduce a type of metatheory on the theories, in effect taking a textual turn on the matter. This textual turn is to look at these theorists as--while describing the same case--actually are coupling events together in different--but productive--fashions.

And to be true to the battle cry of "there's nothing outside-of-text" I will treat these fashions as textual genres.

¹ This paper was presented as a Doctoral Lecture on October 26th 2000. The topic given for the lecture was: *"Explanatory Models in STS: Discuss the comparative strengths and weaknesses of the various theoretical frameworks used in the thesis, e.g. as introduced by Foucault, Winner, Hughes, Pinch/Bijker, and Weber. Support this discussion with examples from the heat pump case."* I would like to thank Knut H. Sørensen, Jan Grande, Margrethe Aune, Per Østby, Jøran Solli and Øyvind Thommassen for valuable comments on the paper.

1 EXPLANATORY MODELS

What I want to do is to use the work of Hayden White--his writings on *Metahistory* as an ordering principle (White 1973). His main interest is how, in which ways a discipline (history) is constituted as a field of knowledge. As a point of departure, he argues that neither the data, nor the event, nor the case determines the "story"--or the way events are remembered, recollected and narrated. He argues that there is some narrative structures that are pre-configuring what are to be acknowledged as the story, as History (or as Science and Technology Studies).

Of course, there is a clear structuralist impulse in such a program. On the other hand, this resembles some of the insights from science and technology studies themselves; for example that facts--or truth--are outcomes, not something that is out there--in nature or in the case.

Basically, the analytical framework White proposes consists of a deep structure and of a surface region; where the deep structure consists of tropic forms, and the surface region have three *modes*, modes of argument, mode of ideological implication, and mode of emplotment (cf. table 1). The mode of emplotment correspond to the classical rhetorical genres.

Table 1: Depth and surface regions in classical genres (White 1973)

<i>Depth</i>	<i>Surface regions</i>		
Tropic forms	Mode of Argument	Mode of Ideological Implication	Mode of Emplotment

First, let me make some general comments about this analytical framework. The framework concerns itself with narration. Narration is the structuring of events into a causal or temporal flow. Narration spans from storytelling to legal accounts to sociological descriptions of a case.

The primary process of narration is how events are ordered into genre-contributing and structuring *functions* in the act of identifying "beginnings", "transitions", "accomplishments". The structuring is answers to questions like: "*What happened afterwards?*" (specific, events), "*Why did things happen in that way?*" (specific, events), "*What is this whole thing leading to?*" (general, answer genre-specific), "*What is the point of it all?*" (general, answer genre-specific).

Obviously, the same set of events can be ordered differently when answering such questions. The point White wants to make here is that this is not a haphazard process ruled by chance and irrational choices. He argues that there exists a *selective affinity* between the different categories, between

how you argue and which genre you are writing in and the ideological implications of it all.

First, in the deep structure, the manifest parts are related in the fashion of classical rhetoric; that is; the *synchedoche*, the *metaphor*, the *metonymy* and the *irony*. The deep structure holds the preferred textual figures for the different genres; for example the textual figure par excellence for the satirical genre is irony. These are the basis--the deep structure for manifest expressions; what he groups into mode of argument, mode of ideological implication and, mode of emplotment. The modes of emplotment equal the traditional genres of classical rhetoric.

Now, I will return to these points when discussing genres in relation to the theorist, hopefully making them clearer.

Second, we have the different modes of arguments. The point here is that the type of arguments used in the ordering of a set of events constitutes--in fact--a spectre of strategies of explanation. These span from organic types of arguments which heralds events and actors inter-connectedness, to contextual arguments, where actors are mere props in the hands of forces stronger than themselves.

Third, White argues that ideology is interconnected to the narrative form that is to be found in these scholarly texts. Ideology works along a set of ordering principles: For example the disposition towards social change that is found, the rate of this change, and the temporal placement of utopia; past, present, or future; as well as the view on contemporary conditions. The ideological modes span from conservatism to liberalism.

Fourth, and the most important part here is found in the different plots. The plots are similar to those found in classical rhetoric, of Romance—comedy—tragedy—satire. The genres differ on a number of accounts. The most optimistic is the romance, the most pessimistic is the satire. I'll present the genres in the next part, while discussing the different theorist.

Let's then move on to the task proper!

1.1 The Romantic Narrative

The first genre, the romance, is characterised by the following. First it is particularizing, no essential or metaphysical unity is to be found. Second, it often describes a relation-free universe of independent, unique actors.

The genre is marked by a language of identity, nevertheless with relatively external relations. Furthermore, the narrative is basically optimistic; we'll find the redemption of man, virtue's victory over sin, light over dark, and the appraisal of goodness. The deep structure textual figure in

this genre is the metaphor: the metaphor signifies identity. For example; "*the heart is the ultimate heat pump*".

It seems to me that two of the theoretical positions I've been asked to discuss places themselves naturally within this genre; the Social Construction of Technology (SCOT)-approach of Pinch and Bijker (Bijker, Hughes and Pinch 1987, Bijker 1995), and the Strategic Niche Management-approach of Mattias Weber (Weber et.al. 1999, Weber and Hoogma 1998, see also Schot, Hoogma and Elsen 1994, Rip, Misa and Schot 1995). Let me take a look at SCOT first.

The central concept of SCOT is the notion of the Relevant Social Group. For example, when talking about material things, or artifacts, SCOT holds that "*A problem is defined as such only when there is a social group for which it constitutes a "problem"*" (Bijker et.al:30). And vice versa, a solution is only a solution when there is a social group for which it constitutes a solution. The following question then arises: Who are the Relevant Social Groups (RSG) here? Or more specific, who are the RSGs in relation to Heat Pumps? The most obvious answer here could be the "enduser"?

But as SCOT defines its program, the RSG concept is a relatively open-ended one: we will have to include not only endusers, but also actors like policymakers, researchers, and these users come in different shapes—some are small, others are large, some are powerful, others are not, and we have the homeowners and the energy utilities (e.g. Oslo Lysverker). Of course the design and development of heat pumps is pressed and shaped by these RSG.

Let us be a bit more concrete. The heat pump is interpreted differently by these RSGs. Following the genre, the heat pump has a romance with different RSG. For the sake of the argument I will mention three RSGs:

The Homeowner: How does s/he interpret this artifact? It could be something like this. A heat pump is complicated machinery, which—if it works—save a lot of energy. Crucial points here are how the heat pump comes across when related to other heating solutions. In Norway the default heating solution is the electric panel heater. One (of many) the problem definitions here is then whether or not the HP is easy to operate; comparing to the electric panel heater.

The Technically Interested. In this group wholly different set of attributes of the artifact is important. Here technical complexity is part of the charm: problem definitions are more likely to be technical performance (especially in terms of total energy savings)

The Energy Utility. For the energy utility—whose main purpose is to sell energy--the heat pump is an ambiguous artifact in terms of problems and solutions. The heat pumps saves energy—which might be good, but it has an unclear impact on load factors and needs for effect, especially on colder

days. Thus, the artifact becomes attractive only for the utilities that already are utilizing their full production capacity.

The problem with SCOT used on HP: Some suitors are excluded—for unruly behaviour; in the Heat Pump case there are examples of RSGs that are excluded for performing adultery with electric panel heaters. Other examples relate to the large subsidies granted for HP installations in the early 90s. Here, small installations, for homeowners, were the first to be excluded from the subsidy. Why?

I would argue that *power* is essential here. But according to SCOT, there is only one aspect of power that would be relevant to the heat pump case. This could be designated as *the semiotic aspect*: RSG fixates the artifact's meaning, in a larger context. Accordingly, the ministry of finance definitions of small HPs as macro-economical dangerous liaison might have been the one which "sticked" with HP, making them untenable.

While romantic, it seems to me, this is only a partial explanation. So, while the SCOT approach foster good descriptions of usergroups and the attraction of problem-definitions, here the question really is: How come some RSGs are seen as not-so-good users and some artifacts are seen as not-so-good? What SCOT seems to lack is a mode of explanation that can point at different "forces", powers, which are deployed.

Relating to this, some important aspects of how power is deployed has been illuminated in the discursive approach of Foucault. I will move on to Foucault later, to see how the concept of a discourse might help. On the other hand, the approach of Mattias Weber (and Strategic Niche Management) does seek to use what they call "national styles of invention", where some "macro"-factors can be accounted for. And the perspectives of SNM are romantic indeed!

The Strategic Niche Management perspective seeks to fuse insights from SCOT with an apprehension of how/what the national styles of invention could be. That is to say, every country have their particular style of making new things/artifacts, and this explain some parts of the diffusion process of similar artifacts and why it differs from country to country. But the primary goal of Strategic Niche Management is to fuse micro- and macrofactors.

The important macrofactors are included in the concept of National Characteristics of Innovation & Diffusion (NSI). Strategic Niche Managment point at institutional factors; labs, policies, professional societies (e.g. engineering) or the national characteristics of relations between users and suppliers. The problem with only using macrofactors is that one gets a rather static model, where macro factors are to explain variables that cut across the system.

Therefore, Strategic Niche Management adds microfactors to account for the dynamics of technological change. SNM makes the empirical observation that many technologies are shaped within a protective niche,

where micro-factors prevail, much like the early phases of mate-selection. SNM state that microfactors are most important in the beginning of the relationship, only later macrofactors become important. One could envision a type of local closure in the SCOT-sense in between.

The *niche* function as a "test bed" (a love nest), the niche gives temporary protection from the "Market" (esp.) and other pressures. These other pressures are what could be called a technological regime. The technological regime represent the whole complex of scientific knowledge, engineering practices, production technologies, product characteristics, skills, institutions, infrastructure; some of these (not all) are very similar to the RSG mentioned by SCOT. Holding onto the romantic genre, the relation between the new technology to the macrofactors amount to meeting the in-laws, setting up a new home, and surviving in the world.

As a preliminary conclusion, Strategic Niche Management includes, but expands the RSG position with more stylish arguments. These can, however be related to the notion of "technological frames" (cf. Bijker 1995). Taking on the heat pump case, SNM adds one step to the SCOT approach.

The most central macro-factors according to this perspective are then the strong impact of an electricity regime. Rather harsh set of in-laws, I'd say ...

But then again: is this sufficient? To me, this seems to presuppose bad intentions on the part of the energy sector, *and* lacks convincing arguments about how these styles work in reality. Thus SNM comes across as being bureaucratic, optimistic, and linear. But then again, this is a romantic story.

1.2 *The Comic Narrative*

The next genre I will discuss is the Comedy. Basic features here are an integrating style, essential identity between part and whole, the whole is to be found in every part—the latter is one of the battle cries of most structuralistic inspired theory.

This genre is not as optimistic as the romance, what we can hope for is the (temporary) triumph of man and possible reconciliation between interests. What's more, the development has a larger purpose, at least a purpose which is hidden from us; we could call this a teleological development, with the concretization of ideas and principles.

The central textual figure here is the Synecdoche: where the whole is represented by the part (e.g. the law for a police officer) or a part is made to represent the whole (e.g. a hand for a sailor).

The comedian of the theorist is Foucault. This might come as a surprise to some of you—maybe most—as many social scientist read him as the ultimate doomsayer: there is no choice, all is power, discipline is everywhere.

Well, not so. I will like to argue that the analytical tools Foucault prescribes will result in a comedy.

Let us first take a quick look at the central analytic concepts. Foucault argues that *power* is exercised through, and not possible to separate from *discourse* (Foucault 1972a). First we must ask, what is discourse? In dictionaries it is defined as "*A formal, lengthy discussion of a subject, either written or spoken.*" (American Heritage 1997)

Foucault has a slightly different take on this (Foucault 1972a, 1972b, see also Dreyfus and Rabinow 1983). He argues that discourse consists of statements and inscriptions--and he is most interested in what could be called "serious speech acts"--and how power--the deployment of it so to speak--is most clearly seen in such acts. Central to this claim is that such speech acts and inscriptions couples knowledge and power, simply because of serious speech act's claim to be knowledge (*savoir*). Let's take one simple example. Take the following speech act: "Heat pump A suffer from low technical performance". If this is coupled with knowledge, it has more impact: e.g. if it is stated by a spokesperson for a research institute it is more powerful than if stated by a singular homeowner. The difference is relation to knowledge...

Discourse and power, then, is constituted in the relation between these speech acts with other types of acts. More, a discourse function as an interpretive vehicle for or within a discipline--i.e. energy economizing, which deems some statements to be "disciplinary" or correct and others are not. Accordingly, discourse determines what sort of talk about energy savings (and which talkers) can be taken seriously.

Let us relate heat pumps to a discursive approach. The HP would be inscribed in the energy-economizing discourse. Within this discourse, economy is arbitrator of good solutions. Consequently, the exclusion of homeowners as a RSG is not a product of problem-definitions or interpretative flexibility, but the operation of a grander discourse with historical roots, inscription in scholarly disciplines and actors' identities. The comic part is, then, the breakdown of the rigid boundary between inside and outside (cf. Schaaning 1997). After identifying energy economizing as a discourse, we are free to try to change it. Good internal methods (say engineering practices) are no more a warranty for a heat pumps success than external goals of morally or economically superior energy consumption. So, there are neither internal explanations (i.e. safe methods) nor external ones (i.e. ultimate goals) which leads to success. On the contrary these things are mixed together in discourse, and we--the actors--are involved in praxis, not principles, and may take active part of the field of praxis (for example as a social scientist in the energy field). We're all in the same boat. And what can we do--why not laugh! Thus, the research agenda of Foucault is a comic one!

On a critical note, materiality and things are not very well accounted for in this approach. On the discursive level material things play only a part

in what Foucault calls "micropower", that is the almost too-good-to-be-true result of the discourse, such as disciplinary technology—especially the Panopticon (Foucault 1991), data handling/retrieval and so on. In all other cases, the play of power is opaque and difficult to grasp. Combining Foucault with another STS theory, however, might help! And here we have the theories of another Frenchman, Bruno Latour (Latour 1987, 1988, 1991, 1993, 1996).

First of all, Latour's *modus operandi* is more organic than Foucault's. For Latour, everything counts, things, people, all are equal actors. So, discourse—in this perspective—is construed with a population of actors (or actants) that are interwoven with artifacts and social relations. Power is understood as a field of stronger and weaker associations—to be powerful is to have the stronger set of associations.

Thus, strength and attractiveness of Heat Pump solutions is a product of which associations it has enrolled. Discourse is but one of these associations; others are important as well, for example the Ministry of Energy or the National Research Council. It is tempting, however, to say that one of the more important associations was missing in the heat pump case—namely the endusers. And another association—the energy-economizing discourse—proved to be too strong an association, shaping heat pumps in unwanted directions.

We'll have to move on. I've been asked to discuss the theories of Langdon Winner and Thomas Hughes as well. The next genre in line is the tragedy.

1.3 *The Tragic Narrative*

First of all, in the tragedy, the future looks bleak! We'll find resignation in the face of the eternal conditions—represented by the electricity regime. The loss of the hero—the heat pump—confirms the permanence of the reigning world order. What could be more fitting for the heat pump? But the tragic loss also includes enlightenment!

More, the central literary figure of tragedy is Metonymy. In metonymy, where phrases which are closely associated are substituted: E.g. Akersgata for the main Norwegian newspapers or optimal energy use and heat pumps. Two of the theorists place themselves within the tragic genre: Langdon Winner and Thomas P. Hughes.

First of all, Langdon Winner is a pessimist. He starts off with stating that "*Technical things have political qualities*" (Winner 1980). Bluntly put, the powers that be invest or insert political agendas into artifacts.

More, technical systems have indirect political consequences *and* certain sets of political orders will only accommodate certain technological

orders. E.g. the social-democrat traditions of Scandinavia aligns nicely with a system of centralized district heating (such as in Sweden). District heating, one presumes, would be more difficult to implement, made to fit within a liberal state (e.g. US) or in a state with no or only a weak centralized authority (e.g. any third world country)

If heat pumps were to succeed in Norway, we would have to ask: what kind of solution is this, what is its political twin? To this, there are some positive "twins", and some negative "twins", politically speaking, that is. The positive answer is the inclusion of a large heat pump in a district heating scheme; a social democrat twin! The negative answer is the homeowner's heat pump. It is not a social-democrat; rather a liberal, each man-his-own type of solution. The liberal heat pump has a tragic flaw as well. The liberal solution will not cry out for state subsidies that they actually needed; and when they actually had subsidies--because of some the initiative of a social democrat (oops!)—they were quickly cut. And the hero dies! What a tragedy!

The problem with Winners genre is the presentation of a type of social determinism: Either it works (fits) or it doesn't. Was it the heat pump's destiny not to be implemented? (or the bridges on Long Island: when built they cement (literally) the policy) Thus it lacks convincing perspectives on process, development, changing paths, breaking out of determinism.

Lets then move on to the last of the theorist that I've been asked to discuss (Hughes 1983, 1987, 1989, 1998). I have—somewhat reluctantly—put Hughes under the header of tragedy as well. Now, he has a type of social-liberal perspective. The good times were in the (near) past. But his agenda and genre is different. His narratives are about genius and master builders. These are persons that force unity out of heterogeneity, personifying whole systems: Thomas Edison and the electric appliances and building of utilities, George Eastman and photography. They are the metonymic figures of large technological systems, potentially (but not always) tragic.

It is important to note the Hayden White distinguishes between "history" (as a discipline) and other stories; other stories are epics. For brevity's sake; an epic is "*an extended story, celebrating the feats of a legendary or traditional hero*" (White 1973).

Whats more, an epic is not science; it is art.

Or to take it, as Northrop Frye (1990) argues; where the epic—as all genres—is established in the relation between the "poet" and her listeners. Therefore, the distinguishing mark of the epic is the "listening public"; listening to a tale. One could very well argue that this precisely the status of the latter works of Hughes' (1989, 1998).

The history of heat pumps, then, would have to be rewritten into a story about heroic efforts—persons like the professors Gustav Lorentzen, Per

Frivik and Arne Bredesen--their struggle and failure. Their tragic flaw--as this is a tragedy--was that they loved their heat pumps too much?

1.4 The Satirical Narrative

The last genre is the satire. It shows a form of disintegration. It shows the other genres' fictiveness, construction. Obviously, the account I've given today *could be* taken as satire. Not so.

The satire is sceptical and relativizing. It shows Man's foolishness, and lack of capacity of ordering the world. It gives functional relations between events. Events and institutions are explained in as a function of something external, for example the zeit-geist. For example, now is the time for doom and decay.

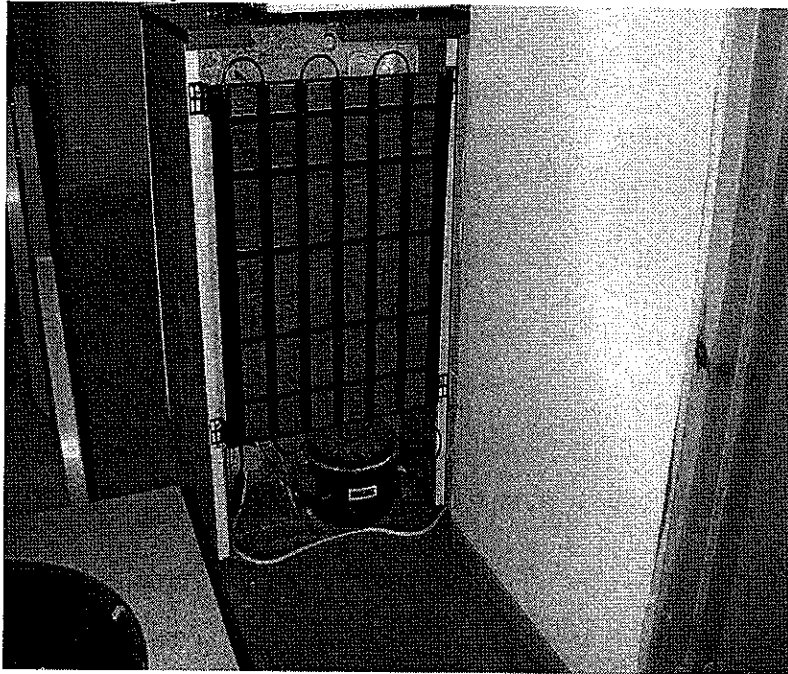


Figure 1: The satirical heat pump.

What's more: I wouldn't say that a heat pump is satirical. The picture (fig. 1) is a heat pump, but it's not. It's in fact an old refrigerator, humming. To sell this worn-out piece of machinery as a heat pump, that would be irony, and lack of capacity of ordering the world.

2 CONCLUSION

But I'm not ironic. What I would argue is that the account I've given here is a good example of what Merton has called "Theories of the middle range". These are theories that lie between the working hypotheses and all-inclusive systematic efforts.

They deal with delimited aspects of social phenomena, and--I would argue--the heat pump case is a well-defined example of precisely that.

Merton argues that in theories of the middle range, one starts out with a single, simple preposition. In the heat pump-case, this could be "Heat pumps are a socio-technical construct". And, to quote Merton: "theories of the middle range [...] are frequently consistent with a variety of so-called systems of sociological theory" (Merton 1967:39pp). Thus, the concept and its associated imagery [...] generates an array of theoretical problems" (ibid.).

The heat pump story presented in my dissertation has been such a case; where different aspects have been dealt with a—maybe eclectic—set of different theories. But these are related, as can be seen in figure 2.

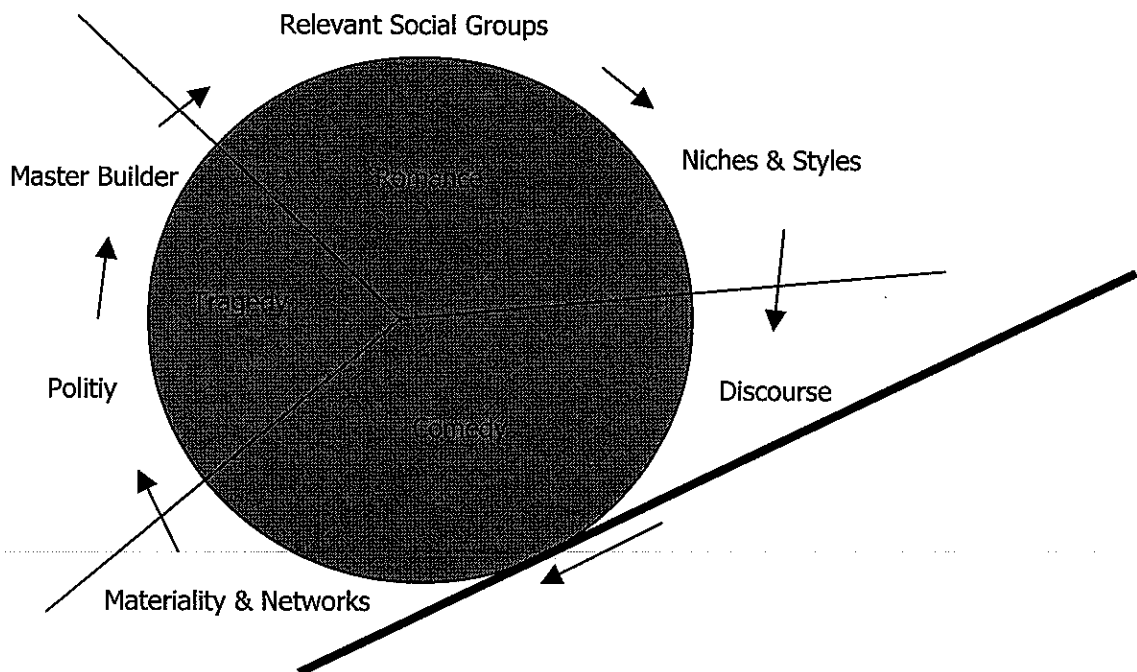


Figure 2: The Sisyphean relation between the different theorist.

We have SCOT on RSGs, which lacks macro-factors, enter Weber on the development of niches, which lacks understanding of power, enter Foucault on the power of discourse, which lacks materiality, enter Latour on networks and associations, which lacks politics, enter Winner on political artifacts,

which lacks an author, enter Hughes on the role of the master builder, which lacks relevant social group, enter SCOT: An Sisyphean task indeed!

But maybe this is all we can hope for?

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