

## 12 Objectual practice

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In this paper, I want to develop some concepts designed to capture the affective and relational undergirding of practice in areas where practice is creative and constructive. Current conceptions of practice emphasize the habitual and rule-governed features of practice. Though much debate surrounds the exact specification of the relevant rules and habits (see Bourdieu 1977; Giddens 1984; Lynch 1993; Turner 1994; Schatzki 1996), most authors seem to agree that practices should be seen as recurrent processes governed by specifiable schemata of preferences and prescriptions. Such processes are doubtlessly prominent in many areas of social life; their existence sustains our sense of practices as customary or routinized ways of behaving. However, it is also a characteristic of current times that many occupations and organizations have a significant knowledge base. In these areas, one would expect practitioners to have to keep learning, and the specialists who develop the knowledge base to continually reinvent their own practices of acquiring knowledge. Practice, in this case, would seem to take on a wholly different set of meanings and raise a different set of questions from the ones raised by habitual activities. For example, how can we theorize practice in a way that allows for the engrossment and excitement - the emotional basis - of research work? What characterization of practice might make the notion more dynamic and include within it the potential for change? Research work seems to be particular in that the definition of things, the consciousness of problems, etc., is deliberately looped through objects and the reaction granted by them. This creates a dissociation between self and work object and inserts moments of interruption and reflection into the performance of research, during which efforts at reading the reactions of objects and taking their perspective play a decisive role. How can we conceive of practice in a way that accommodates this dissociation?

In this paper, I want to address these questions by taking as my starting point a particular characterization of knowledge-centered practice - one that can be traced back to Heidegger but that also finds support in scientists' self-understandings of their work. At the core of this characterization lies the assumption that creative and constructive practice - the kind of practice that obtains when we confront nonroutine problems - is internally more

differentiated than current conceptions of practice as skill or habitual task performance suggest. The dissociation I have in mind is that between subject and (work) object; though time differentiation is also important, I think subject-object differentiation captures more directly what happens when work ceases to be habitual procedure. What holds differentiated practice together and gives it continuity is the relationship between subject and object; this paper is a first attempt to find the basis of knowledge-centered constructive and creative practice in a relational rather than a performative idiom. In moving in this direction, I assume that the relational idiom adequately captures the dynamic properties of research. The relational idiom can also carry the reflexive and affective aspects of epistemic practice. In addition it will bring into focus nonhuman objects, which dominate much of expert work.

In the next section, I briefly review knowledge society arguments - those which maintain that professional knowledge activities are expanding in current Western societies and constitute the leading edge of postindustrial work. If these arguments are right - if we are confronted with the growth of knowledge-centered and knowledge-based activities in many areas of social life - epistemic practices may come to dominate other kinds of practice. The specific characteristics of these practices then also become interesting from a practice theory viewpoint. In the third section, I discuss reasons for a relational approach to conceptualizing practice. I will briefly revisit Heidegger's perspective on these matters, and also present examples of how experts and scientists themselves view constructive practice.

To specify how object relationships define the flow of practice one needs to discuss in some detail the notion of 'object' relevant to knowledge activities. This will be the topic of the section that follows. Knowledge objects differ in important ways from the commodities, instruments, and everyday things discussed in the literature; the section spells out these differences, conceiving of epistemic objects as defined by their lack of completeness of being and their nonidentity with themselves.

The lack of completeness of being of knowledge objects goes hand in hand with the dynamism of research. Only incomplete objects pose further questions, and only in considering objects as incomplete do scientists move forward with their work. In the fifth section, I turn to the subjects rather than objects in attempting to specify further the relational and affective dynamic of expert practice. This section presents a way of conceiving of the bindingness, reflexivity, and mutuality of experts' object relationships as the backbone of this practice.

### **The knowledge society argument**

What drives one to think about knowledge-creating and -validating or 'epistemic' practice? A recent source of concern with knowledge-centered activities are transformation theory arguments. These arguments conceive of current social transitions in terms of a shift from an industrial to a

'postindustrial' or 'posttraditional' society, in which knowledge is of increased relevance to the economy and other areas of social life. There is a widespread consensus today that contemporary Western societies are increasingly ruled by knowledge and expertise. The proliferation of concepts such as that of a 'technological society' (e.g., Berger et al. 1974), an 'information society' (e.g., Lyotard 1984; Beniger 1986), a 'knowledge society' (Bell 1973; Drucker 1993; Stehr 1994), a 'risk society' or 'experimental society' (Beck 1992; Krohn and Weyer 1994) embodies this understanding. The recent source of this awareness is Daniel Bell (1973), for whom the immediate impact of knowledge was on the economy, where it resulted in such widespread changes as shifts in the division of labor, the development of specialized occupations, the emergence of new enterprises and sustained growth. Bell and later commentators (e.g., Stehr 1994) also offer a great many statistics on the expansion of R&D efforts, R&D personnel, and R&D expenses in Europe and the United States. More recent assessments have not changed this argument so much as added further arenas of the impact of knowledge. For example, Habermas's argument about the 'technicization' of the lifeworld through universal principles of cognitive and technical rationality attempts to understand the spread of abstract systems to everyday life (1981). Drucker (e.g., 1993) links knowledge to changes in organizational structure and management practices, and Beck (1992) depicts transformations of the political sphere through corporate bodies of scientists. Finally Giddens, arguing that we live in a world of increased reflexivity mediated by expert systems, extends the argument to the self, pointing out that today's individuals engage with the wider environment and with themselves through information produced by specialists which they routinely interpret and act on in everyday life (e.g., 1990).

The advantage of Giddens's use of the notion expert 'system' is that it brings into view not only the impact of isolated knowledge items or of scientific-technical elites but implies the presence of whole contexts of expert work. These contexts, however, continue to be treated by him and others as alien elements in social systems, elements that are best left to their own devices. Knowledge society arguments consider knowledge as a productive force that - in a postindustrial society - increasingly plays the role that capital and labor played in industrial society. These viewpoints also emphasize the role of experts, of technology and its associated risks, and of electronic information structures (see also Lash and Urry 1994). But the transition to knowledge societies involves more than the presence of more experts, more technological gadgets, more specialist rather than participant interpretations. It involves the presence of knowledge processes themselves - in the terms chosen here, it involves the presence of epistemic practice.

From the present point of view, then, understanding knowledge societies will have to include understanding knowledge practices. In postindustrial societies, knowledge settings are no longer limited to science. To give an example, every major bank employs scores of 'analysts' and other 'specialists,' who research and represent for the bank the world in which the bank moves.

Hence research and analysis practices of different kinds penetrate many areas of social life: to some degree, these practices become constitutive of these areas. For example, global financial markets could not exist without the symbolic representations and analyses of trading activities and contextual events that are created by specialists in information provider firms and similar organizations. In other words, the reality of global financial markets is an expert-provided and expert-observed 'on screen' reality. The practices of creating this screen reality will need to be analyzed with respect to the specific knowledge-producing and -validating strategies they implement; as earlier work suggests, knowledge-producing activities in different areas entail different epistemic cultures (see Knorr Cetina 1999). But also at stake is the conceptualization of knowledge-centered practice from a theoretical perspective which is the topic of this paper.

### The relational undergirding of epistemic practice

I now want to begin to describe this practice, starting with the observation of the dissociative dynamic that comes into play when practice ceases to be a procedural routine. As indicated before, the dissociation relevant here is that between subject and object. What do we mean by this dissociation? How does it come about, and why is it important? The separation between subjects with mental states and independent objects is common to all areas of everyday life. To take an example, a car and its driver are distinct entities in our perception and in much of our experience. Nonetheless, while I am driving, my car becomes what Heidegger calls 'ready-to-hand' and transparent (Heidegger 1962: 98ff): it has the tendency to disappear while I am using it. In other words, the car becomes an unproblematic means to an end rather than an independent thing to which I stand in relation. It becomes an instrument that has been absorbed into the practice of driving, just as I, the driver, have been absorbed into the practice of driving - I, too, become transparent. When I engage in this practice, I am oriented to the street, the traffic, the direction I have to take. I am not oriented to the car - unless it malfunctions and temporarily breaks down. Nor am I thinking of myself as separate from the immediate activity.

It should be plain that scientific practice, when it is routine or habitual, corresponds to this description. To give an example, consider the following comments of a researcher in a molecular biology laboratory whom I asked about her usage of laboratory protocols (for details see Knorr Cetina 1999: Chapter 4):

DS: You asked about protocols. We not only work with protocols, we think in terms of them. When I am doing the protocol, pipetting say, I don't really think about the objects I am dealing with. When it's a routine, there is, for me, no differentiation between the bacteria that I am using there, and the DNA that I'll extract and the enzyme that I am placing on

to cut the DNA. 'A thing to do' is more a protocol than dealing with DNA, it is more in the procedure than in the material.

Or consider another molecular biologist in the same laboratory, who described the practice of cloning in the following terms (see Knorr Cetina 1999: Chapter 6):

HB: Cloning is perhaps one level below what one calls exciting in the lab. You sit down, you think about a particular construct, and then you clone it. That's not very different from deciding to dig a hole in the ground and then to dig it - it's about that exciting.

This sort of practice can perfectly well be described in a performative idiom that conceptualizes it, in Wittgenstein's terminology, as an 'ungrounded way of acting' (Wittgenstein 1969: nos. 110,17e; see also Dreyfus 1995:155). Yet it appears equally clear that major portions of knowledge-centered work - those that best epitomize epistemic practice - are not adequately described in just these terms. These portions of scientific practice are not, in the above terms, 'routine procedures'; they occur when problems arise, or when work is new to a researcher. Consider again an example, the first researcher's response, at a later point in our conversation, to a question about the protein she was working on:

KKC: What about your protein?

DS: Well, the protein, because it has previously been a problem, the protein is a bit more moody. I think about it, I get more visual, I treat it differently, in one word, I pay more attention to it, it's more precious. I don't handle it routinely yet.

KKC: How do you visualize it?

DS: I see the protein in a certain size in front of me. I visualize why it is precipitating, then I visualize the solution and I visualize the falling out and the refolding process. I also visualize the protein denaturing, stretched out and then coming together, and I visualize how it is being shot into the solution and what it is going through when it starts to fold. With the expression, I visualize the bacteria when they grow in a more anthropomorphic way, why are they happy? I try to visualize them shaking around, I visualize aerobic effects, the shaking, how much they tumble around and what could have an effect.

In this second case, the object (e.g., the protein) is no longer 'invisible' and undifferentiated, an undistinguishable part of an activity script. Instead, it becomes enhanced and in fact enlarged through the researcher's strategy of visualizing it and its environment and behavior under various circumstances. It is important to note not only the subject-object differentiation this entails, but also the researcher's active usage of the means we have to overcome subject-object separation - her deployment of *relational resources*. Not only

does this researcher experience herself as a conscious subject that relates to epistemic objects, she draws upon resources that are entailed in 'being-in-relation' in everyday life to help define and continue her research. I take these relational resources to include taking the role or perspective of the other; making an emotional investment (taking an interest) in the other; and exhibiting moral solidarity and altruistic behavior that serves the other person. In the present case, DS can be said to take the role and perspective of the protein and of her bacteria; she also imagines the latter's emotions, engaging in what is perhaps a form of empathy. In the following comment on her protein, DS indicates her own emotional involvement:

KKC: Is it [the protein] like a person? Someone you interact with?

DS: No, not necessarily a person. It takes on aspects of some personality, which I feel, depending on if it has been cooperative or not. If it's cooperative then it becomes a friend for a while, then I am happy and write exclamation marks in my book. But later it becomes material again, it goes back to being in a material state. When it stops doing what I want, then I see a personal enemy and think about the problems.

From the subject-object differentiation and the relational definition of the situation DS reaps, one imagines, insights, clarity about next moves, epistemic dividends. In other words, DS uses relational mechanisms as resources in articulating and 'constructing' an ill-defined, problematic, nonroutine and perhaps innovative epistemic practice.

When Heidegger analyzed our instrumental being-in-the-world as a form of un-self-conscious but nonetheless goal-directed employment of equipment in its referential context he also pointed out what happens when equipment becomes problematic (Heidegger 1962: 98ff.): then we go from 'absorbed coping' to 'envisaging,' 'deliberate coping' and to the scientific stance of 'theoretical reflection' on the properties of entities. This characterization recaptures the ones I have given, with perhaps one difference. Heidegger came to characterize knowledge in terms of a theoretical attitude that entails a 'withholding' of practical reason. He gave an important characterization of how the project of science appears derivative, of the primordial stance of taking things for granted in everyday life. But, at the same time, his characterization provided less than an adequate account of knowledge processes - in which the presence of equipment is massive, instrumentality prevails, and theorizing rather appeals to us as being itself a form of practice. With the notion of a theoretical attitude, Heidegger brought back into the picture the subject-object differentiation which he had wanted to drive out of the philosophical discourse with his definition of 'Dasein' as a form of concerned coping ('Self and world belong together in the single entity, Dasein. Self and world are not two entities, like subject and object': cf. Dreyfus 1995: 67ff.). But perhaps as a consequence of his larger project, Heidegger never quite gave situations of subject-object distanciation the same consideration and

attention that he gave to concerned coping. Theoretical knowledge, for Heidegger, remained a form of 'thematizing' that objectifies objects from a position of detachment. Heidegger did not develop the idea that this 'detachment' simultaneously makes possible relationships in which one can dwell and which can be extended and unfolded through relational mechanisms and resources. I take the position that Heidegger's detachment should rather be recast in terms of the notion of differentiation (between subject and object); that differentiation entails the possibility of a nexus between differentiated entities which provides for our integration in the world (for a form of being-in-the-world); and that this form of being-in-relation also defines a form of 'practice' - in particular, it defines epistemic practice.

### **What is an object? Objects characterized by a lack in completeness of being**

The 'alien' tissue element of epistemic practice that now needs further discussion is that of an object.<sup>1</sup> How can we characterize knowledge objects and why do they require special attention? One reason for discussing epistemic objects is that our everyday notion of an object (take Heidegger's 'hammer') would seem to contradict the features of objects that scientists and other experts encounter. To spell out these features I want to start from a suggestion by the historian of biology Rheinberger, who means by 'epistemic things' any scientific objects of investigation that are at the center of a research process and in the process of being materially defined. Objects of knowledge are characteristically open, question-generating and complex. They are processes and projections rather than definitive things. Observation and inquiry reveals them by increasing rather than reducing their complexity. Rheinberger also emphasizes that what an object is at present to some degree depends on how its future develops (see below). Rheinberger is interested in the historical structure of research programs which oscillate around objects of knowledge that escape fixation (e.g., Rheinberger 1992).

Building upon Rheinberger's ideas, I want to characterize objects of knowledge ('epistemic objects') in terms of a lack in completeness of being that takes away much of the wholeness, solidity, and the thing-like character they have in our everyday conception. The everyday viewpoint, it would seem, looks at objects from the outside as one would look at tools or goods that are ready to hand or to be traded further. These objects have the character of closed boxes. In contrast, objects of knowledge appear to have the capacity to unfold indefinitely. They are more like open drawers filled with folders extending indefinitely into the depth of a dark closet. Since epistemic objects are always in the process of being materially defined, they continually acquire new properties and change the ones they have. But this also means that objects of knowledge can never be fully attained, that they are, if you wish, never quite themselves. What we encounter in the research process are representations or stand-ins for a more basic lack of object.

From a theoretical point of view, the defining characteristic of an epistemic object is this changing, unfolding character - or its lack of 'object-ivity' and completeness of being, and its nonidentity with itself. The *lack in completeness of being* is crucial: objects of knowledge in many fields have material instantiations, but they must simultaneously be conceived of as unfolding structures of absences: as things that continually 'explode' and 'mutate' into something else, and that are as much defined by what they are not (but will, at some point have become) than by what they are. The idea that 'every component of an organism is as much of an organism as every other part,' uttered by a scientist to whom a particular plant had exploded in that way, can perhaps capture the idea of an unfolding ontology. The *unfolding ontology* of objects foregrounds the temporal structure, and, to put it into the original Freudian terms, the *Nachträglichkeit*<sup>2</sup> in definitive existence of knowledge things (their post-hocness), which is difficult to combine with our everyday notion of an object. I will argue in the next section that it is the unfolding ontology of these objects which accommodates so well the structure of wanting, and binds experts to knowledge things in creative and constructive practice.

There are other characteristics. Epistemic objects frequently exist simultaneously in a variety of forms. They have multiple instantiations, which range from figurative, mathematical, and other representations to material realizations. Take the case of a detector in a high-energy physics experiment. It continually circulates through a collaborating community of physicists in the form of partial simulations and calculations, technical design drawings, artistic renderings, photographs, test materials, prototypes, transparencies, written and verbal reports, and more. These instantiations are always partial in the sense of not fully comprising 'the detector.' 'Partial objects' stand in an internal relation to a whole. The instantiations I have listed should not be conceived of as a halo of renderings and preparatory materials anticipating and representing *another* object, 'the real thing.' It is 'the real thing' itself that has the changing ontology which the partial objects unfold. But do physicists not mean, by a detector, the physical machine *after* it has been built and *when* it is complete and running? Is the object not always an intended, an imagined whole? My point here is simply that as an intended object, a detector is an endlessly unfolding project consistent with the above circumscription of an epistemic object as marked by a lack in completeness of being. We should also consider that the boundaries of a technical instrument such as a 'running detector' are still highly problematic: only parts of the instrument tend to be operational at any one time, the physical machine will not run without remote controls, without computers and other equipment connected to it, and the instrument exists for most practical purposes mainly in the form of detector (component) measurements, representations, and simulations (it is literally put behind lead walls and inaccessible while it is running). Finally, even when such an instrument is officially declared 'finished' and 'complete,' the respective experts are acutely aware of its faults, of how it 'could' have been improved, of what it 'should' have become and did not.

The 'finished,' working detector, then, is itself always incomplete, is itself simply another partial object. The notion of an imagined object captures the ontological difference between current instantiations and a possibly more complete ideal, or in another sense extended object. The imagined object might itself be instantiated in design drawings that project a future or hidden state. In this sense a concrete, imagined object is also a partial object, albeit one that stands in relation to an available, occurrent object state as an object that marks the difference to this state. As historical studies show, scientists sometimes map out ideal objects in publications even when current techniques are not able to produce them (e.g. Borck 1997: 6).<sup>3</sup> But imagined objects can also split and divert current practice by projecting a new possible object, one that calls into question current concerns or simply departs from them in lateral ways. This is how current practice often gets constructively extended into new strands.

To return now to the partial object: I do not conceive of it as a gliding replacement for any presumed 'real' object in the sense of a referent. Partial objects, like epistemic objects in general, do not derive their immediate practical significance from the real. The point I want to draw attention to is the signifying force of (partial) epistemic objects by virtue of the internal articulation of these objects. Consider a transparency containing a curve which indicates the increasing 'downtime' of, say, a computer over its lifetime. The curve does not just 'represent' the unspecific experience that the instrument needs repairs over time. It specifies the exact way in which repair incidences accumulate. It may show that there is a small but steady increase of such incidences in the first years, followed by a steep and bumpy downtime increase during midlife, and a slow increase in a generally high incidence of repair shutoffs during older age. From the curve, one can try to decide at what points to replace the instrument. This will make apparent the need for further information, for example about the level of downtime that is acceptable to a project - the curve is telling, but not (ever) telling enough. What one can decide is what points of the curve to explore further to obtain the missing information. For example, one can calculate the cost of data losses through downtime before and after a steep decline in repair incidences. The signifying force of partial objects (of epistemic objects in general) resides in the pointers they provide to possible further explorations. In this sense these objects are meaning-producing and practice-generating; they provide for the concatenation and constructive extension of practice. One can also say the significance of these entities resides in the lack they display and in the suggestions they contain for further unfolding (for a more complicated theoretical physics example, see Merz and Knorr Cetina (1997: 918)).

Thus in creative and constructive practice, (partial) epistemic objects have to be seen as transient, internally complex, signifying entities that allow for and structure the continuation of the sequence through the signs they give off of their lacks and needs. Their internal articulation is important for the continuation of epistemic practice; not just their difference to other

objects, as in a Saussurean linguistic universe. I do not see partial epistemic objects as elementary units into which a complex whole is decomposed, but rather as complex links which extend a practical sequence at least partly through being unfoldable into equally complex sublinks. An example from everyday life might be a computer equipped with the relevant software. The computer can be 'unfolded' into signifying screens and subscreens, which stimulates in users an epistemic and affective relationship with the instrument (see also Turkle 1995).

I have been emphasizing the *unfolding, dispersed, and signifying (meaning-producing)* character of epistemic objects, and particularly their nonidentity with themselves, to bring out the divergence of this idea of an object from everyday notions of material things. I must now add a word about the role naming plays in relation to these objects. The point I want to remind us of is a simple one: a stable name is not an expression and indicator of stable thinghood. Rather, naming, in the present conception, is a way to punctuate the flux, to bracket and ignore differences, to declare them as pointing to an identity-for-a-particular-purpose. I tend to think that one can see a stable name for a sequence of unfolding objects as a way of translating between different time zones, among others personal and institutional time zones. For example, when a sequence of objects and partial object states is called a 'liquid argon calorimeter,' it is brought into accord with project-financing requirements, work organization principles, institutional career tracks, and so on. A typical example of constantly changing or unfolding objects (also familiar from everyday life) are computer programs. In expert programming, authors write, run, and update the code to suit their own changing interests. At the same time they serve a community of users for whom they may issue the code in 'versions,' 'updates,' program 'family' members, and so on (see Merz 1997). The packaging of progressive modifications in recognizable 'versions' and 'updates' requires a special effort, which the author makes taking into account user needs. The notion of unfolding refers to the evolution of a sequence of which certain segments (and possibly other segments) are gathered together by applying identical names to them. The process of naming and that of unfolding (and dispersion) are independent of each other, and might even stand in contradiction to one another.

### Epistemic practice as sustained by object relations

A number of suggestions about how epistemic practice might be conceived have been implicit in the discussion so far. I now want to address these more directly and systematically. I limit myself to two features of epistemic practice: its underlying relational dynamic and the lateral branching out of this practice. The first feature pertains to a kind of practice that is dynamic, constructive (creative), and perhaps conflictual. As indicated before, contemporary accounts favor a conception of practice in terms of habits and routines. As a consequence, these authors seek to explain practice (understood as practices)

by an appeal to the embodied acquisition of preferences, perceptual schemes and dispositions to react, and by an appeal to shared tacit rules. The former is more the Bourdieu and Dreyfus line of thinking; in the latter case, the nature of the rules, and their exact relation to practical activity, lies at the core of controversies (see Bourdieu 1977; Dreyfus and Dreyfus 1986; Lynch 1993; Turner 1994; Rouse 1996b; Schatzki 1996). In both cases, practice requires participants to have learned something which they subsequently deploy or enact in concrete situations. In contrast, I see epistemic practice as based upon a form of relationship (see also Knorr Cetina 1997; Greenberg and Mitchell 1983) that by the nature of its dynamic transforms itself and the entities formed by the relationship.

What sort of relationship? Consider once more epistemic objects as described before. I want to maintain that the open, unfolding character of knowledge objects uniquely matches the 'structure of wanting' with which some authors have characterized the self. I derive this idea from Lacan (e.g., 1975), but it can also be linked to Baldwin (1973: 373ff.) and Hegel.<sup>4</sup> Lacan derives wants not as Freud did from an instinctual impulse whose ultimate goal is a reduction in bodily tension, but rather from the mirror stage of a young child's development. Wanting or desire is born in envy of the perfection of the image in the mirror (or of the mirroring response of the parents); the lack is permanent, since there will always be a distance between the subjective experience of a lack in our existence and the image in the mirror, or the apparent wholeness of others (e.g., Lacan and Wilden 1968; Alford 1991: 36ff.). One can also attempt a rendering of the lack in a representational idiom that is closer to the present concern. Accordingly, wants are always directed at an empirical object mediated by representations - through signifiers, which identify the object and render it significant. But these representations never quite catch up with the empirical object; they always in some aspects fail (misrepresent) the thing they articulate. They thereby reiterate the lack rather than eliminate it.<sup>5</sup> To relate this now to epistemic objects, the point I made before is that the representations experts come up with in their search processes are not only partial and inadequate, they also tend to imply what is still missing in the picture. In other words they suggest which way to look further, through the insufficiencies they display. In that sense one could say that objects of knowledge structure desire, and provide for the continuation and unfolding of object-oriented practice.

Let me say a little more about what it is that the notion of a structure of wanting offers; one has some explaining to do when turning to a sociologically arcane language such as the one I choose. The Lacanian ideas I use serve to specify objectual relations, which I see as the touchstone of a practice centered on epistemic objects, as relationships based upon a form of mutuality: of objects providing for the continuation of a chain of wantings, through the signs they give off of what they still lack; and of subjects (experts) providing for the possibility of the continuation of objects which only exist as a sequence of absences, or as an unfolding structure. What need not concern us further is

Lacan's account of the lack in subjectivity as rooted in the child's narcissistic relationship to him/herself rather than to a lost person, or his explanatory trope of the mirror stage. One need not find the Lacanian account of the mirror stage persuasive in order to find the idea of a structure of wanting plausible. The latter is a convenient way to capture the way wants have of continually searching out new objects and of moving on to them - a convenient way, if you wish, to capture the volatility and unstoppable of desire. With regard to knowledge the idea of a structure or chain of wantings brings into view whole series of moves and their underlying dynamic rather than isolated reasons, as the traditional vocabulary of motives, intentions and actions does. It also suggests a libidinal dimension or basis of knowledge activities - which is ignored or denied when we conceive of science and expertise as cognitive endeavors.

I believe that the existence of such a dimension is borne out by the intensity and pleasurability of objectual relations as experienced by experts. It is also 'in tune with' ontological reorientations towards 'experience,' etc., in the wider society as diagnosed by some (Welsch 1996). The notion of a knowledge society is not at odds with, for example, that of an experiential society, or with a turn toward a more visual and visually simulated world - what it is at odds with is an arid and overly cognitively tilted notion of knowledge. The conduct of expertise has long harbored and nourished an experiential *mentalite*, if 'experience' is defined, as I think it should be, as an arousal of the processing capacities and sensitivities of the person. The conjunction of the relational and libidinal dimension gives practice a flavor and quality distinctively different from that of routines and habits.

It remains for me to add a note about the lateral and angular branching off of strands of practice. The notion of unfolding when applied to practice can easily be understood as a forward-pointing sequence of steps driven by the interlocking dynamic of a structure of lacks and wantings. However, this would ignore the frequent splitting of activities into different strands, and the possible displacements of one strand by another. Such lateral shifts imply the transference of wants and relational substance from one chain of objectual involvements to another. As the study of science shows, processes of inquiry rarely come to a natural ending of the sort where everything worth knowing about an object is considered to be known. The idea of a structure of wanting implies a continually renewed interest in knowing that appears never to be fulfilled by final knowledge. But it also implies that interest may turn elsewhere, that it jumps the rails of one line of practice and continues on a different track in a somewhat different direction. The angularity of epistemic practice, its continual lateral divergence from itself, needs further discussion which I cannot offer here. Suffice to say that angular splitoffs add a disruptive element to the conception of practice I advocate, an element of conflictual breaks not generally recognized in current conceptions of practice.

### Summary and conclusion

The notion of a knowledge society suggests that knowledge-centered practice focused on epistemic objects becomes a prominent part of all areas of social life. I have characterized the objects involved (which may be natural things, instruments, scientifically generated objects, etc.) in terms of their unfolding ontology, the phenomenon that they may exist simultaneously in a variety of forms, and their meaning-generating connective force. These ideas also suggest a notion of practice that is more dynamic, creative, and constructive than the current definition of practice as rule-based routines or embodied skills suggests. The challenge we face, with the present argument, is to dissociate the notion of practice somewhat from its fixation on human dispositions and habits, and from the connotation of iterative procedural routines. I propose to conceive of the backbone of practice in terms of a relational dynamics that extends itself into the future in creative and also in disruptive ways. This relational dynamics does not simply mean the existence of positive emotional ties between individuals and nonhuman objects: We can theorize the sort of object relations addressed in this paper better through the notion of lack, and of an interlocking structure or chain of wantings, than through positive ties and fulfillments. The notion of a structure of wanting entails the possibility of a deep emotional investment in objects; an involvement that is at the same time congruent with the many flavors and orientations of this investment.

Epistemic environments cannot be understood, I want to maintain in concluding, without understanding expert-object relationships. Knowledge-centered work shifts back and forth between the performance of 'packaged' routine procedures and differentiated practice as described in this paper. It is with respect to differentiated practice that a relational idiom becomes plausible and may help in conceptualizing chains of activity. It may also become relevant to object-oriented practice outside knowledge contexts. In a knowledge society, objects in many areas of social life begin to display the kind of internal complexity and dynamic extendability that they have in science and expertise. Computers, financial instruments (Zelitzer 1994), sophisticated sports equipment are typical examples - these appear on the market in continually changing versions, they are both ready to hand and subject to further development and investigation. As objects in everyday life become high-technology devices some of the relational aspects of their existence in expert contexts also carry over into daily life. Some of the problems these devices raise in everyday contexts may well have to do with the relational demands they make and for which some lay users may not be prepared. Conversely, the appeal these objects have for some users may also consist in the relational opportunities they offer (for computers, see Turkle 1984, 1995). When epistemic objects become epistemic everyday things, the relational approach I have advocated may also become relevant to understanding daily work activities and instrumental action.

Lacan's account of the lack in subjectivity as rooted in the child's narcissistic relationship to him/herself rather than to a lost person, or his explanatory trope of the mirror stage. One need not find the Lacanian account of the mirror stage persuasive in order to find the idea of a structure of wanting plausible. The latter is a convenient way to capture the way wants have of continually searching out new objects and of moving on to them - a convenient way, if you wish, to capture the volatility and unstopability of desire. With regard to knowledge the idea of a structure or chain of wantings brings into view whole series of moves and their underlying dynamic rather than isolated reasons, as the traditional vocabulary of motives, intentions and actions does. It also suggests a libidinal dimension or basis of knowledge activities - which is ignored or denied when we conceive of science and expertise as cognitive endeavors.

I believe that the existence of such a dimension is borne out by the intensity and pleasurability of objectual relations as experienced by experts. It is also 'in tune with' ontological reorientations towards 'experience,' etc., in the wider society as diagnosed by some (Welsch 1996). The notion of a knowledge society is not at odds with, for example, that of an experiential society, or with a turn toward a more visual and visually simulated world - what it is at odds with is an arid and overly cognitively tilted notion of knowledge. The conduct of expertise has long harbored and nourished an experiential *mentalite*, if 'experience' is defined, as I think it should be, as an arousal of the processing capacities and sensitivities of the person. The conjunction of the relational and libidinal dimension gives practice a flavor and quality distinctively different from that of routines and habits.

It remains for me to add a note about the lateral and angular branching off of strands of practice. The notion of unfolding when applied to practice can easily be understood as a forward-pointing sequence of steps driven by the interlocking dynamic of a structure of lacks and wantings. However, this would ignore the frequent splitting of activities into different strands, and the possible displacements of one strand by another. Such lateral shifts imply the transference of wants and relational substance from one chain of objectual involvements to another. As the study of science shows, processes of inquiry rarely come to a natural ending of the sort where everything worth knowing about an object is considered to be known. The idea of a structure of wanting implies a continually renewed interest in knowing that appears never to be fulfilled by final knowledge. But it also implies that interest may turn elsewhere, that it jumps the rails of one line of practice and continues on a different track in a somewhat different direction. The angularity of epistemic practice, its continual lateral divergence from itself, needs further discussion which I cannot offer here. Suffice to say that angular splitoffs add a disruptive element to the conception of practice I advocate, an element of conflictual breaks not generally recognized in current conceptions of practice.

## Summary and conclusion

The notion of a knowledge society suggests that knowledge-centered practice focused on epistemic objects becomes a prominent part of all areas of social life. I have characterized the objects involved (which may be natural things, instruments, scientifically generated objects, etc.) in terms of their unfolding ontology, the phenomenon that they may exist simultaneously in a variety of forms, and their meaning-generating connective force. These ideas also suggest a notion of practice that is more dynamic, creative, and constructive than the current definition of practice as rule-based routines or embodied skills suggests. The challenge we face, with the present argument, is to dissociate the notion of practice somewhat from its fixation on human dispositions and habits, and from the connotation of iterative procedural routines. I propose to conceive of the backbone of practice in terms of a relational dynamics that extends itself into the future in creative and also in disruptive ways. This relational dynamics does not simply mean the existence of positive emotional ties between individuals and nonhuman objects: We can theorize the sort of object relations addressed in this paper better through the notion of lack, and of an interlocking structure or chain of wantings, than through positive ties and fulfillments. The notion of a structure of wanting entails the possibility of a deep emotional investment in objects; an involvement that is at the same time congruent with the many flavors and orientations of this investment.

Epistemic environments cannot be understood, I want to maintain in concluding, without understanding expert-object relationships. Knowledge-centered work shifts back and forth between the performance of 'packaged' routine procedures and differentiated practice as described in this paper. It is with respect to differentiated practice that a relational idiom becomes plausible and may help in conceptualizing chains of activity. It may also become relevant to object-oriented practice outside knowledge contexts. In a knowledge society, objects in many areas of social life begin to display the kind of internal complexity and dynamic extendability that they have in science and expertise. Computers, financial instruments (Zelitzer 1994), sophisticated sports equipment are typical examples - these appear on the market in continually changing versions, they are both ready to hand and subject to further development and investigation. As objects in everyday life become high-technology devices some of the relational aspects of their existence in expert contexts also carry over into daily life. Some of the problems these devices raise in everyday contexts may well have to do with the relational demands they make and for which some lay users may not be prepared. Conversely, the appeal these objects have for some users may also consist in the relational opportunities they offer (for computers, see Turkle 1984, 1995). When epistemic objects become epistemic everyday things, the relational approach I have advocated may also become relevant to understanding daily work activities and instrumental action.



**Notes**

- 1 If there is one aspect of knowledge cultures on which received viewpoints on science and expertise and the newer studies of science and technology agree then this is that knowledge cultures centrally turn around object worlds to which experts and scientists are oriented (for the new sociology of science, this has been emphasized particularly by Callon [e.g., 1986] and Latour [e.g., 1993]). For interesting attempts to work with these ideas by historians and sociologists of science see, for example, Pickering (1995a), Wise (1993) and Dodier (1995). For an important study of individuals' attachment to computers see Turkle (1995). Thevenot's (e.g., 1994b) concepts provide perhaps the most general sociological perspective on the issue.
- 2 Freud illustrated the principle for some mental disorders: some childhood experiences turn out to have been profoundly disorienting and disorder-promoting only after a person develops a mental disorder, which may happen decades after the experience occurred.
- 3 Borck's example refers to Einthoven's publication of an ideal graphic registration of the heart in 1895 as an emblem of the curves of later electrocardiographs.
- 4 Baldwin's and Hegel's notions of desire are summarized by Wiley (1994: 33).
- 5 In putting it this way I draw on Baas's rendering of Lacan's notion of a thing - albeit without claiming that my reading here is correct (Baas 1996: 22f.).