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The Time of Materiality

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Abstract: While time and space form a classic duality in social science, this article demonstrates a perspective on time, space and materiality as a core trinity. As a prominent figure in contemporary discussions on materiality in the social sciences Science and Technology Studies (STS) emphasizes relational approaches. STS however lacks a clear relational definition of materiality and tends instead to focus on the agency of entities, on for instance material agency. The article suggests a relational definition of materiality and notes that this move implies turning the question of the time of materiality into an empirical question. It is argued that relational materiality must be studied spatially, and thus a spatial approach describing *patterns of relations* is presented. Based on field work in a primary school classroom and computer lab, three materials are analyzed: the blackboard, a bed-loft and an online 3D virtual environment. The empirical descriptions depict three different materialities, and it is shown how time is formed differently in each of them. Time, it is argued, is an emergent and characterizing aspect of materialities as spatial formations.

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1. Introduction

Materiality has been touched on and discussed by classic philosophers and social scientists, but it has not until recently reached a central position in social scientific debates. We especially find discussions on materiality in the field of STS. With a strong influence from the methodological approaches of anthropology the discussions of materiality within STS are almost exclusively conducted through empirical research. Studying the time of materiality the present article does not deviate from this norm. My approach to materiality has been mangled through the empirical field of primary school, which is on the other hand quite unusual to STS. The empirical work to be discussed consists of participant observations and observing participation. Apart from my research group[1], the participants of my

1 Consisting of Nina ARMAND, Agnete HUSTED-ANDERSEN, Morten JACK, Kenneth JENSEN, Tine JENSEN and myself.

study were a Danish and a Swedish 4th grade primary school class with respectively 24 and 20 9-10 year old pupils. Three teachers took part in the Danish part of the study, while only one took part in the Swedish part. My research interest was to study how different learning materials participated[2] in and contributed to forming school practices. I followed this interest by studying classroom practices and practices in the school's computer lab (SØRENSEN, 2005, 2006). [1]

The studies in the computer lab were centered on an online 3D virtual environment. The Danish and the Swedish classes engaged in a seven weeks project in which the pupils collaborated over the Internet. The project was set up by my research group in collaboration with the schoolteachers, I and the other members of my research group were positioned as observing participants. We designed the online 3D virtual environment specifically for this project and in the computer lab we took part in the activity as teachers. I return to the description of the virtual environment design below. Due to our intimate participation in the activity in the computer lab field notes could only be written after each session. The focus of my field notes was the involved materials, and the field notes always took a point of departure in the virtual environment or other materials involved in the practice, and followed the course of action from these. [2]

In order to get an understanding of the particularities of the materials, I compared the studies of the virtual environment with a quite different study of the classroom practices. It took place in the Danish 4th grade that also participated in the virtual environment project. My classroom observation followed a classic participant observation approach (KLETTE, 1998). As agreed with the teacher and explained to the pupils I was positioned in the back of the classroom with my notebook not participating in the activities of the classroom, but as a visitor. For 20 hours a video camera accompanied me in the rear left corner of the room, covering almost the whole class. My notes and my viewing of the videotapes concerned the materials of the classroom: mainly learning materials such as blackboard, textbooks, notebooks, pencils, dictionaries etc., but also tables, chairs, bodies, walls, time schedules and other materials not defined as learning materials but nonetheless crucial for the constitution of learning practice. [3]

The focused attention to the detailed participation of materials in the two settings of the 4th grade provided a good platform for discussing materiality on an empirical basis. The analyses to be presented are of a *spatial* character, following a topological reading of STS and of FOUCAULT (e.g. BINGHAM & THRIFT, 2000; CRANG & THRIFT, 2000; LAW, 1999, 2000b; MOL & LAW 1994; PHILO 2000; THRIFT 1996). In this article a spatial approach to materiality is in the center of the attention, but as a shadow-discussion, the issue of temporality is also considered. Time moves more and more into the limelight as the article progresses, and eventually I conclude the inseparability of materiality, space and time. Time and space are classic dimensions of studies in social science; often explicitly discussed and sometimes implicitly treated in empirical and theoretical

2 I use HIRSCHAUER's (2004) notion of participation, which applies to subjects as well as objects.

work. By adding the relational notion of materiality to the duality of time and space, I show how this new space-materiality-time trinity can be used as an analytical move to conduct a consistently relational empirical account. [4]

2. Towards a Relational Notion of Materiality

Discussions of materiality and the role of materials in practice have over the past decades been of increasing interest to a large number of social scholars, especially STS. In social science *objects* are typically treated as parts of the context, environment or field for social action. One of the protagonists of STS, Bruno LATOUR, has directed some of his sharpest critique of social science especially at the separation of social action and context (e.g. LATOUR, 1993). The acts of individual actors in social science are often tied to social interests, social representations and general beliefs or other external—or contextual—determining or mediating parameters. Such contextual parameters are generally[3] described as non-emergent and at best temporally stable, at worst as atemporal (PICKERING, 1993). Materials are treated in association with these external, contextual parameters, as resources for or symbols of these. Realized human action, on the other hand, is treated as temporally ephemeral. HØSTAKER (2005, p.17) notes that "realized acts are aligned with this pre-established context and suddenly the researcher has an explanation for why actors actually did what they did." LATOUR refuses to let context explain social action and thus to let the stable explain the ephemeral. Consequently, a central issue of LATOUR's theory becomes the question of the role of material objects in what he then prefers to call *socio-material* agency. However, neither LATOUR nor STS scholars in general occupied with materiality dwell on the efforts to formulate a clear definition of materiality. At times, "material" is discussed as synonymous with "object," "technology," or "thing," and often "materiality" refers to the "physical" aspects of entities or simply to anything "non-human" (e.g. IHDE & SELINGER, 2005, p.9). [5]

Philosophers and social scientists of earlier times have defined the material in a variety of ways. KANT distinguished *matter* from *substance*. Matter referred to the superficial and thus temporally variable appearance of an object, while substance was its permanent in existence. Contrary to KANT, HEGEL defined matter as physical in contrast to "content," the latter referring to mind, spirit, the abstract or ideal. Following HEGEL's binary opposition, MARX changed the significance of the two concepts. He kept HEGEL's understanding of material as embracing physicality, but additionally he let the material be central to the formation of phenomena; of "content." Even with their quite different notions of the material and materiality, these theorists all describe material and materiality as having to do with entities. Phenomenologists related the notion of material to ontology of things, and HEIDEGGER produced longer meditations on the meaning of "thing" (Ding) in contrast to "object" (Gegenstand). The former was described as a *gathering*, which I see as a step away from associating materiality with entities,

3 Except for example in pragmatist and social-interactionist approaches.

towards a relational approach. Discussing the distinction between "thing" and "object," LATOUR ironically notes

> "the handmade jug can be a thing, while the industrially made can of Coke remains an object. While the latter is abandoned to the empty mastery of science and technology, only the former, cradled in the respectful idiom of art, craftsmanship, and poetry, could deploy and gather its rich set of connections" (LATOUR, 2004, p.233). [6]

LATOUR appreciates HEIDEGGER's description of the thing as a gathering, but far from happy with the distinction between thing and object, he goes on to demonstrate the ways in which technological objects are just as much gatherings as things are. The space shuttle Columbia must in HEIDEGGER's terms be defined as an object, LATOUR states. All of a sudden, however, this technological object was transformed into a

> "shower of debris falling on the United States, which thousands of people tried to salvage in the mud and rain and collect in a huge hall to serve as so many clues in a judicial scientific investigation … suddenly, in a stroke, an object had become a thing" (LATOUR, 2004, pp.234-5). [7]

It is such gatherings—or networks or assemblages, as they are more often called in STS—of social (i.e. human) and material (i.e. non-human) entities that become central in LATOUR's Actor-Network Theory (ANT). The material is thus never to be studied as part of a context, environment or field for social action, nor in contrast to any form of (socially mediated) "content." Materiality is always to be studied *relationally* with the social, as a component part of socio-material hybrids (e.g. LATOUR, 1993). [8]

This methodological symmetry allows the researcher to describe the temporally coinciding *co-existence* and *interplay* of the material and social rather than ephemeral social action as *separate from* but taking place *in* a material and stable context. I position myself as a grateful successor of these virtuoso thoughts. However, as an STS scholar I repeatedly find myself trapped in this vocabulary. On the one hand, I learn to think of any entity I encounter as a socio-material *gathering, hybrid, network or assemblage*. On the other hand, I am offered the notions of achieved social and material *agency* or *identity* to describe the gathering, hybrid, network or assemblage. In my view, notions like agency and identity turn the gathering, hybrid, network or assemblage back into actors or units that are hard to think of in other ways than in relation to some kind of external context in relation to which the agency or identity is defined. [9]

While LATOUR departs from the above-mentioned modern thinkers and establishes a *relational* approach, he however keeps the association of the material and materiality to *entities*. In an attempt to remedy this inconsistency, I suggest we focus on the *pattern* of the gathering, hybrid, network or assemblage or whichever relational notion we may prefer. Thus, we may understand materiality as *the formed pattern in which a particular entity takes part and which allows it to relate in particular ways to (an)other particular entity(ies)*. With this

definition, we can talk about the materiality of materials as well as about the materiality of social entities. Materiality is, notably, not an essential property of an entity, but a distributed effect. The materiality of an entity achieves its particularities through the way in which it is arranged with other entities. Moving from an understanding of materiality as associated with entities in a temporally stable context to a relational comprehension, the temporality of materiality is no longer pre-given; neither as stable nor as ephemeral. The question of the materiality as well as the time of materiality of an entity thus becomes an empirical matter[4]. As we shall see, time indeed becomes a defining aspect of materiality. [10]

3. Studying Materiality as Patterns of Relations

Applying a relational concept of materiality in empirical descriptions means according to the above considerations to describe the *pattern* in which the entity in question is part. I have elsewhere (SØRENSEN 2005) developed the notion of *patterns of relations* to describe materiality through the patterns formed by the relations a particular entity in concert with other entities establishes to these particular other entities. The notion of pattern is sometimes taken as an attempt to generalize. However, as VARENNE and MCDERMOTT (1998) note, the particularity of an entity is gained through the entities that together make a pattern. Describing materiality in terms of patterns of relations is thus a way to establish sensitivity to particularities as effects of relations. [11]

I understand the description of patterns of relations as a *spatial approach*, which is a characteristic several authors have also attached to Actor-Network Theory (e.g. LAW, 2002a; BINGHAM & THRIFT, 2000). PHILO's discussion of FOUCAULT provides a good account of what it means to characterize an approach as spatial:

> "I would argue that when Foucault gazes out on the social world of the past, he sees not the order of (say) a mode of production determining the lines of class struggle nor the order of (say) a worldview energising everything from how the economy functions to how the most beautiful mural is painted: rather, he sees the spaces of dispersion through which the things under study are scattered across a landscape and are related one to another simply through their geography, the only order that there is here is discernible, by being near to one another or far away, by being positioned in certain locations or associated with certain types of environment, by being arranged in a certain way or possessed of a certain appearance thanks to their plans and architecture" (PHILO, 2000, pp.220-1). [12]

PHILO argues that a pivotal aspect of FOUCAULT's theory is that he approaches social life and especially history in *spatial terms* instead of viewing history as a temporal line of progress—in civilization, in technology, in knowledge—seen from

4 Even though ELGAARD JENSEN's notion of materiality differs from mine in his article in this issue, his understanding of time as empirically emergent is in line with the argument I set up here. ELGAARD JENSEN nicely demonstrates how the specific formation of time called "future" is constituted as a rhetorical-material configuration.

the perspective of the present as the so far highest stage of development. FOUCAULT criticized what he calls *total history*, which implies a critique of coherence (total) and a critique of developmentalism (history). In PHILO's reading FOUCAULT solves both problems through applying spatial strategies. [13]

PHILO notes that FOUCAULT's critique of coherence targets the tendency of historical accounts to produce an *overall* form of civilization, a *singular* principle of society, a *unitary* significance common to all phenomena of a period. Analogous to this, descriptions of materials are often total in character, focusing on the functioning of a thing or a machine in definite and singular terms, often presented by the view of the designer. According to PHILO, FOUCAULT finds such total descriptions suspect because the measure of order they introduce … "smoothes over the specific confusions, contradictions, and conflicts which have been the very 'stuff' of the lives led by 'real' historical people, powerful and powerless alike" (op.cit, p.210). [14]

Total descriptions remain alien to the details and differences of practice at particular times and particular places. It creates an order in which everything fits in with everything else, where all elements have their right place. In his assault on what PHILO calls "the castle of coherence" FOUCAULT proposes the method of *general description* as an alternative to total descriptions: "A total description draws all phenomena around a single centre—a principle, a meaning, a spirit, a world-view, an overall shape; a general history, on the contrary, would deploy the space of a dispersion" (FOUCAULT, 1972, p.10). By noting that general descriptions *deploy the space of a dispersion*, FOUCAULT introduces a spatial imaginary of objects located over, below, on the top of, just to the right of, along the road, further ahead, beyond your imagination, apart from, a little closer, inside, etc. Applying a spatial view instead of a view on order, principles or significance FOUCAULT creates descriptions at the level of socio-material interactions rather than elevating them to a level of meaning, ideas or generalities. [15]

Secondly, FOUCAULT moves away from describing history (or technology) as a series of progressive developmental stages by describing the *spatial relations* deeply implicated in historical processes: the distribution and arrangement of people, activities, and buildings. As is crucial for the argument of this article, it shall later become clear that spatial approaches do not imply that time cannot be part of the study. FOUCAULT is not interested in excluding time from social research. He fights a *particular* depiction of time, namely time as a singular, orderly progression. Rather than ignoring time, a spatial approach is about conceptualizing time as different from a progression. Understanding time as emergent and thus as an empirical matter, as I shall discuss below, I see the main challenge in not simply creating sensitivity to understanding time as different from a progression, but realizing that progression is only one of the forms in which time appears. [16]

Think of FOUCAULT's *Discipline and Punish* (FOUCAULT, 1979). Think of the way he describes the arrangement of schools by moving from the division of

children into classes of the same age, over to the division of subjects and sorting of these according to precise time tables, and further on to the classification of curricula by increasing levels of difficulty, to the ordering of pupils at designated desks arranged in rows facing the teacher, and to the sanctioning of some body movements and the exercising of others through the teacher's voice or stick tap signals, and so on. FOUCAULT takes up an entity, describes how it is related to others and how it contributes to forming relations, moves along these relations onto an adjoining entity and studies the unfolding of similar techniques and the relations between entities and how they influence each other. FOUCAULT does not follow a chronological principle, nor the effects of a central power or "heroes," nor the governing of one logic or principle. Instead of trying to describe the object of study relative to one principle, one meaning or in any way to a singular point or direction, FOUCAULT's spatial approach describes the distribution of objects *relative to one another*. He moves from object to object along their mutual relations, and thereby step-by-step *describing the space* that this particular arrangement of objects deploys or performs[5]. Following FOUCAULT in the attempt at creating spatial descriptions is thereby not an attempt to localize *entities* in space, measure their geographic distance or localize them in a certain place. It is about describing *relations* and characterizing the patterns these relations form. To characterize the patterns of relations, I draw extensively on three *spatial metaphors* suggested by LAW and MOL (LAET & MOL, 2000; LAW, 1999, 2002b; LAW & MOL, 2001; MOL & LAW, 1994). [17]

As a first step, this approach thus decenters (DREIER, 1993) the research question under consideration—the time of materiality—and describes initially the spatial pattern of the material in question. Secondly, the question of the time of the materiality is described as the characteristic of the spatial pattern of the materiality. The aim of the descriptions below is twofold: First, they serve to provide details to and concretize the theoretical and methodological arguments. Furthermore—and more importantly—the inseparable trinity of materiality, time and space first appears clearly through empirical analysis. The following section each concern one material I encountered during my fieldwork in the school: a blackboard, a bed-loft and an online 3D virtual environment. [18]

5 FOUCAULT applied spatial strategies in his attack on progressive time as well as in his critique of totality. While the attack on progressive time seems quite successful in FOUCAULT's own and followers' writings, the same writings have failed to overcome the totalizing character. Spatial techniques are no vaccine against totalizing accounts. Totalizing descriptions "from above" and with a "god's eye view" are indeed also spatial. In his studies of power FOUCAULT did not look at one singular totalizing power as the *source* of history, but his accounts do seem to add up to describing one—the disciplinary—power as an *effect* of contingencies, practicalities and particular located practices. A solution to this risk of producing total spatial description can be to apply *multiple* spatial metaphors, which imply that spaces never perform only one singular, total pattern of relations (e.g. MOL, 2002; LAW, 2002a).

4. The Regional Materiality of the Blackboard

The first object I discuss is the blackboard. It hangs on one of the four walls of the classroom. In front of it the teacher's desk is placed. We start with a field note excerpt. It is a Danish lesson in the 4th grade at St. Marc Street School. I am seated in the back of the classroom with a notebook on my lap and a pencil in my hand. The teacher arrived a few minutes ago, assisted by a teacher from the neighboring class, each with a pile of dictionaries. My field note reads:

> "The dictionaries are distributed while the teacher explains that today they are going to learn how to use a dictionary. A necessary qualification for using a dictionary, she adds, is being familiar with the alphabet.
>
> Let's sing the alphabet song, the teacher says and picks up the chalk pencil from her desk. She turns to the blackboard and raises her hand with the chalk to the blackboard. With her body facing the blackboard she turns her face towards the class and asks 'are you ready'? This makes me curious. Ready for what? Everyone apparently knows what is going to happen. Except for me. The teacher takes a deep demonstrative breath and starts the song: 'a, b, c, d …'. Already at 'a' the children join in and with their eyes fixed on the blackboard they sing the song out loud and clear. On the blackboard the teacher writes the letters one by one at the pace of them being mentioned in the song. It doesn't look easy to keep up with the pace of the song. By the end of the song the 28 letters of the Danish alphabet are written on the blackboard. The teacher turns around and facing the pupils she says with a smile: 'I made it'." [19]

All pupils were seated at their desks. The teacher was at the blackboard, writing. The pupils were carefully watching the teacher's writing. Or more precisely: they were watching the letters appearing on the blackboard. O'DAY et al. (1998) note that the blackboard (or whiteboard in their study) works as a "focusing feature."

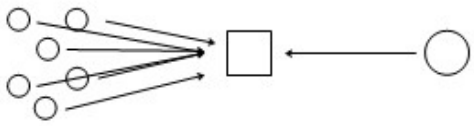

Figure 1: Children paying attention to the emerging letters on the blackboard that the teacher is writing [20]

Figure 1 is an attempt to sketch the principle of the pattern of relations making up the socio-material assemblage of children (o), letters on the blackboard (□) and the teacher (O). The letters on the blackboard were in the center of the attention. The teacher and the emerging visual materiality of the letters she was writing on the blackboard co-constituted one single and central *geographic place* in which the letters were produced. The pupils' gazes were all fixed to the blackboard and the relation between the gazes and the production of letters created a *distance* between the blackboard and the rest of the classroom. The blackboard constituted a place outside the children, whereby a "here" and "there" was

established. A geographic "here" and "there." Here the blackboard, there the pupils (or vice versa). [21]

This pattern of relations can be described as *regional* (LAW, 2002b; LAW & MOL, 2001; MOL & LAW, 1994). Regionality is an arrangement of well-delimited regions separated by boundaries. Inside each region you encounter similarity. Differences are to be found between regions. The region metaphor fits the assemblage of children, letters on the blackboard and teacher. Three aspects characterize the pattern of relations around the blackboard as regional: [22]

One characteristic of the regional pattern of relations is its performance of separate regions. The blackboard assemblage created a central place at the blackboard and a place from which this place was viewed. Two separate regions were performed; one with the teacher and one with the pupils. There were also words ("orientational metaphors" as LAKOFF & JOHNSON [1980] call them) involved in performing these two places. "Laila, please come up to the blackboard," the teacher could say, and when the pupil had done what she was asked to at the blackboard she would be asked to "go down to your seat." There were two distinct places—"up here" at the blackboard and "down there" by the pupils. Two regions of different stances were performed by and through the assemblage around the blackboard: the writing teacher at the blackboard and the singing and reading pupils. [23]

A second characteristic of the regional pattern of relations is the creation of *differences* between regions. The blackboard region was the teachers' "home." Teachers more often wrote on the blackboard than pupils did. They had chalk pencils with their names engraved on them. These pencils protected the skin of their fingers from drying out as a consequence of holding the chalk for so many hours every day. And the chalk pencils contributed to performing the difference between teachers and pupils. No pupil had a chalk pencil. As rare writers on the blackboard they had no need for those pencils. The chalk pencils revealed the teachers' special alliance with the blackboard and the blackboard region. [24]

The third characteristic of the regional pattern of relations is related to the second. It concerns the boundaries between regions. The boundary in the classroom was performed through the act of crossing it; when those not "at home" in a region entered it. Even though the teachers were the most frequent writers on the blackboard, they were not the only ones. Sometimes, a pupil was called to the blackboard, which however did not necessarily mean he was going to write on the blackboard. "Going up to the blackboard" meant going to the *region* of the blackboard, not necessarily to write on the blackboard. We consult my field notes again:

> "It is the library lesson in which pupils can either go to the school library to take out books, stay reading in the classroom or write book reviews either at their desks or in the computer lab. When a book is finished a review has to be written. After half an hour in which some pupils have been in the library, others in the computer lab and some stayed in the classroom, all pupils and the teacher are again gathered in the

> classroom. The teacher has corrected a few book reviews, which she holds in her hand. Standing in front of the blackboard she asks: 'Who would like to read their review out loud'? Three children raise their hands. Nina is one of them. 'Nina, please come up', the teacher says. Nina goes to the blackboard. Now seated the teacher hands out Nina's review to her saying loudly: 'Nina liked this book very much, so pay close attention. Maybe others might want to read it'.
>
> Nina has taken the review out of the plastic folder. She stands next to the seated teacher in front of the blackboard facing the rest of the class. She reads the review. When finished, the teacher says 'Very good, Nina' and without a sign the pupils applaud." [25]

By moving her body from the pupils' region to the blackboard to read a text out loud, Nina's voice gained attention from all pupils in quite a similar way to the writing on the blackboard. It happened often that a pupil's presentation at the blackboard was followed by applause. This never happened as a reaction to presentations given from the pupil's desks. The different reactions to similar presentations at different places contribute to perform a *boundary* between the region of the pupils and the region of the blackboard. [26]

Even though pupils could cross the boundary to the blackboard region they were clearly "guests" here: They only entered this region when being explicitly permitted access. Teachers were mistresses of the blackboard region, they were the ones who regulated who could enter the region and when. Furthermore, applauses frequently followed pupils' presentations at the blackboard. Teachers were never applauded. They were not guests, they were at home. Consequently, what they did in the blackboard region was ordinary, while what the pupils did there was *extra*ordinary. [27]

It was not much of a spectacle when the teacher moved to the region of the rest of the classroom. However, playing the videotape fast forward from my classroom observations I noticed how the teacher always went down to one, two or three pupils to talk to them individually when they were working on their own with the exercise books. Then she walked back to the blackboard, stood there for a while, returned to talk to one or two pupils, went back to the blackboard again, etc. Sometimes she would write notes on "her" blackboard to remind herself of things to be explained later. But most often she would just stand next to the blackboard for a minute or two before she went "down" again to another pupil. It was as if an invisible rubber band always pulled her back to her "own" region, at the blackboard. The teacher was clearly only a temporary visitor to the region of the rest of the classroom, while her "home" was at the blackboard. Like the pupils the teacher always only stayed briefly in the "other" region, and her movements between and different presences in the "home" space and the "visited" space created a boundary between the two. [28]

The materiality of the blackboard was regional. Through the particular arrangement and particular coordination of the blackboard, a song, chalk and chalk holders, a teacher's and pupils' bodies moving, words said and hands

clapping, a pattern was formed which allowed the blackboard to relate to the pupils, teacher and other materials in a regional way. On the basis of this spatial description of the blackboard, we can now turn to the time of this materiality. The regional pattern is like a structure that stays as it is. It establishes an absence of time. It does not involve any change or development. Time does not play a role in the assemblage; it does not make a difference. No, more than that: Regionality has no time. It does not have a lifetime or horizon of existence pointing at a future collapse. It is atemporal, ahistorical, performed without time. [29]

5. The Network Materiality of a Bed-Loft

I spent most of my classroom observation time seated under a big bed-loft. St. Marc Street School was built in 1882 and lives up to the ideal of the day that schools should be stout and tall, looking down on the surrounding tenement houses. Consequently, the classrooms are high-ceilinged. In collaboration with a school of carpentry the 4th grade class had built a large wooden bed-loft in the corner of the classroom, about six meters square and two meters tall, as a refuge for pupils during breaks, for group work, etc. (see Figure 2). The bed-loft was central on the class agenda during my visit. Consider this field note excerpt:

> "Wednesday morning. For an hour the class is busy preparing the bed-loft inaugural ceremony. They bring up soft-drinks and sandwiches made by Suzan's mum. They arrange the food and drinks nicely as a buffet on a few desks put together. Some pupils sweep the floor and decorate the windows, windowsills and the blackboard. They put all school bags to the wall. A song for the occasion written by one of the teachers is distributed on printed sheets. The classroom door is open. Children pass in and out from and to the neighboring class, who is preparing as well. The other class was also part of the carpentry project and has also built in a bed-loft in their classroom. Around 11 o'clock parents start turning up. They chat with the teachers and with children. Some sit down at the pupils' desks, some stand. The principal arrives. At 11:15 the bell rings. One of the teachers comes into the classroom and says: 'Its time, come over!' We all pass to the neighboring class where we are told to gather by the walls. We are almost 70 people packed by the four walls of the classroom. One of the teachers initiates the song, and we all read from the printed sheet in our hands, singing about the fabrication and erection of the bed-lofts. After the song, the principal makes a speech celebrating the project and the pupils' hard work. Then follows three speeches held by pupils, who are all a bit tense and clearly excited by their performances. The speeches are each followed by long applauses. One of the teachers invites everyone for drinks and sandwiches and the crowd moves to the other classroom."

Figure 2: The bed-loft during the inaugural ceremony [30]

Being new and original the bed-loft constituted a legitimate reason for making a celebration at which the different groups of people with interest in the work of the class could gather. Being so conspicuous the bed-loft almost invited partners to witness it, which was a reason for people to attend the celebration. By enrolling the parents and the principal the bed-loft contributed to performing a *network* of not only the teacher, the pupils and their work, but also of otherwise external parties. The notion of network is the second of LAW and MOL's spatial metaphors I introduce here in order to describe the materiality of the bed-loft. The network pattern of relations is characterized as a *heterogeneous* assemblage. Heterogeneous in the sense that it is constituted by entities of different kinds—teachers, parents, a bed-loft, speeches, a song for the occasion etc. The entities of a network are not positioned in "containers" or regions as in the regional pattern of relations. Proximity of entities in a network is dependent on their semiotic relations: a parent can be close to the headmaster, while far away from his wife. The bed-loft contributed to connecting heterogeneous elements in quite particular ways. It made gatherings available to groups of people who in one way or the other had interests in the progress of the class. Groups that were otherwise (in regional terms) beyond the class were drawn into the class, making it "bigger than itself." Because they were coming and because they could be invited a song for the occasion and several speeches could be written and performed. At the same time the song for the occasion and the speeches helped to tie the parents, headmaster, bed-loft, teacher and pupils together. All entities depended on each other. This is another feature of the network pattern of relations: All elements are involved in making up this pattern of relations. If you remove one, the others cannot keep their place. Each entity has to stay in place and do its job. [31]

Thinking of the temporality of the network materiality, and thus of the bed-loft we must take the *event* character of the inauguration ceremony into account. The network pattern of relations is often described as a temporally stable materiality,

as an immutable mobile (e.g. LATOUR, 1987). This is very much due to the immense work that is put into tying elements together to form a network—as in our example the sandwiches, speeches, songs, parents, headmaster etc. LATOUR talks about sizes of networks: large networks are more stable and possess more strength than small ones[6]. Accordingly, LATOUR might diagnose the network tied together by way of the bed-loft as in risk of failing and crumbling. However, as part of an event the bed-loft could not be considered to fail when the inauguration ceremony ended. The inauguration ceremony—as any event—was established to be brief. Not all networks amount to immutable mobiles. Events do not. So, what happened when the sandwiches were eaten up and the headmaster went somewhere else to give another speech? Would the parents keep talking about the bed-loft and thereby continue contributing their effort to keep the network together and granting the bed-loft legitimacy? The *event* character, which the bed-loft was so good at establishing due to its immensity and thereby availability for (or even invitation to) witnessing also meant that the bed-loft easily connected to sandwiches and soft drinks, speeches and songs and thereby to parents and headmaster's visit to the classroom. This assemblage, however, depended on *co-presence.* Eating sandwiches, singing a song together and witnessing the bed-loft all require geographical co-presence. Because the sandwiches would be eaten up and the speeches and song would only be performed once, the parents and headmaster would also only stay briefly. These materials thus all contributed to the short temporality of the event, and thus to the passing of the network materiality of the bed-loft. Indeed, we may understand the bed-loft as a kind of hub or boundary object (STAR & GRIESEMER, 1989) connecting a variety of different people and materials. As long as no *representations* of the bed-loft were incorporated into the network materiality in terms of leaflets, video or other materials that could easier circulate (LATOUR, 1999) than the bed-loft itself and thus make the bed-loft be witnessed virtually (SHAPIN & SCHAFFER, 1985), the bed-loft would not be able to establish an robust network materiality[7]. [32]

6. The Fluid Materiality of the Online 3D Virtual Environment

The last object I discuss is an online 3D virtual environment. Such a computer program runs on personal computers and presents the user with a graphic world in which she can move around a little character—a so-called *avatar*. The virtual world is online which means that other users can log into the same world and communicate and interact with your avatar in the virtual environment.

6 For further clarification of LATOUR's description of how networks gain strength and become immutable, see ELGAARD JENSEN, in this issue.

7 There were representations incorporated into the network. Speeches and songs were indeed representations of the bed-loft. These representations, however, depended on "live" performance, which cannot circulate without the persons performing them, and thus they only temporarily can contribute to tying the social actors to the representations. Note the similarity between this statement and the observation put forward by KONTOPODIS in this issue (following SCHEFFER) that some embodied utterances are local while filed and otherwise "reiterated" statements are translocal and lasting, which is a conception SCHEFFER takes further in his contribution to this issue. In order to keep the focus of my argument, my account of the "live" and the "represented" performances are without any further analytical discussion. The relationship between the two are however complex, as MOTZKAU nicely shows in her discussion in this issue of mediated child witnesses in courtroom hearings.

Furthermore, users of the virtual environment can build homes, landscapes, fire stations etc. inside the virtual world[8]. Together with my research group I designed this technology to run in a Swedish and a Danish 4th grade class who collaborated over the Internet. We called the design *Femtedit*, which apart from the graphic design of the virtual environment, a web-site, and a number of blogs among other things consisted of a frame story. The frame story told about a virus attack on the Femtedit virtual world, which had erased the homes of the virtual creatures—the Femteditians—who lived there. The children's mission was to recreate the identities of the Femteditians. These identities were established by making hyper-links from objects in the virtual environment to Internet sites that could be taken from wherever the children came across URLs in their everyday lives. The children could communicate with their Femteditians (enacted by the researchers) through a "blog."[9] The following story is created out of a combination of field notes, of what children and researchers wrote in blogger and of the visual appearance of the online 3D virtual environment:

> "Five boys were busy building a house for the Femteditian Tvia. Michael, Tim and Pete from the Danish group had chosen dun brown granite wall plates and were arranging them in two big squares slightly staggered. They wanted to build something 'big and pretty'. It was not easy to make the wall plates fit. While struggling with the plates they explained that their building had to be as tall as possible. They had not even managed to complete the first floor yet. More granite wall plates were attached. Ola and David, their Swedish team mates, put a TV in front of the 'empty'[10] Tvia, to make sure she wasn't bored while waiting for them to reanimate her. And they put in floors and walls of water inside the house and added the sound of water to these elements.
>
> Tvia responded in blogger: 'Great building!!! Please, link to some good pages … weak … help … oh … need more memory …'. Tvia required more hyperlinks for its reanimation.
>
> Michael, Tim and Pete started surfing. Tim found an animation on the Internet and linked it to the TV their Swedish partners had built in the house. 'I have made a film,' he wrote in blogger. Michael linked to some satiric anti-terrorist web pages. There was an animation about Osama Bin Laden. 'Look at this, look at this,' Pete said excitedly, handing out the headphones to Tine Jensen, my colleague. Tine watched and listened to the animation about how to 'bash' Mr. Laden. She didn't know how to react. She found it repellent and felt the urge to forbid the link immediately. On the other hand, she wanted to let the frame story play its role, which implied that feedback was motivated by the relations and happenings inside the online 3D virtual environment and not by external criteria for what was good or bad. She told Pete that

8 For further description, see http://www.activeworlds.com/edu/.

9 "Blog" is short for "web-log." It is an online program, which makes it very easy to write on a web page. The blog used in the project is available at http://www.blogger.com/.

10 The Femteditian Tvia was described as "empty" in the sense that her identity was erased, due to the virus attack. She would during the time of the project be "filled" with hyperlink and thus regain identity and agency. Until then Tvia would stand as a frozen graphic representation in the virtual world without moving. On the last session of the project all the Femteditians were finally reanimated, and were thus moving around in the virtual environment and communicating with the children. During this session, the Femteditian's avatars were enacted by a few friends and colleagues from an office at the university.

> she personally found the joke distasteful because of its glorification of violence, its dumb US centrism and its ignorance of the complexities of the conflicts between the US government and its Muslim enemies. Pete shrugged his shoulders and turned to the online 3D virtual environment.
>
> Tvia didn't comment on the satiric web pages but on the divergence in what the children built: 'Thanks for all you have built. It is so nice. It gives me strength, but my mind is divided. I am CONFUSED. It is as if I were two persons. It is because you do not collaborate. The Swedish children try to rebuild my old house. The Danish children try to build as big as possible—you need to start agreeing …'.
>
> Pete changed the surface of the 'water' walls and floor to granite and industrial metal respectively. Ola put a skating image on the TV and two armchairs in front of it. Michael changed the skating image to a Digimon[11] figure, which David overwrote by an image of a speedboat. Tim found a web page with pictures of bombs that he put right in front of their house and next to a few animations of fireworks, which he called 'explosions:' 'It's the Twin Towers,' he said smiling proudly to Tine." [33]

The sequence describes a vast number of objects that were built and several links added to the building blocks. It reveals a zigzag course from the wish to build something big and pretty to naming the building Twin Towers. Around and in between other wishes, objects and links come into play. The pattern of relations performed in the sequence is one of *single elements coming together one after the other*, neither following any set plan nor directed towards a goal. First there was a wish to build something big, then the granite plates, then the anti-terrorist web pages, then the idea of the Twin Towers. We need not to understand "Twin Towers" as the conclusion to the story, as summing up or embracing all other elements. Maybe it was just added to the elements already connected. An addition, however, that influenced the character of the flow of the elements. Just as the antiterrorist web pages altered the tall granite building and the putting together of granite wall plates shaped the idea of building something big. But it was not one object influencing the others in a stable structure. Each new element influenced the *flow* of the procedure constituted by the assemblage of elements. Step-by-step elements were put together, each contributing to the direction of the journey. [34]

The *fluid* metaphor describes a pattern of entities coming together one after the other, not a pattern of summing up to form a more and more robust entity but a pattern of the latest elements attached influencing the direction of the process (LAET & MOL, 2000; LAW, 1999, 2002b; LAW & MOL, 2001; MOL & LAW, 1994). This also implies that during the course of events some links and building blocks were replaced, while others changed or lost effect. The elements were *optional* and *exchangeable* which is characteristic of fluid patterns of relations. Some elements were in focus at one point but then they faded into the background. Sometimes they were exchanged and replaced. Just as some reappeared and regained importance. The relations between elements in fluid patterns of relations are *unstable*. [35]

11 "Digimon" is an abbreviation of Digital Monsters, an animated TV series to which a lot of franchise is available; collectible card games, digital games, comics, and movies. Digimon is one of the most popular global figures in contemporary child culture.

The story of the Twin Towers emerged as a zigzag course around and between interactions, wishes, graphic objects and links, etc. There was much more than the story of the Twin Towers in the sequence above. There was a TV and a sofa, a film, a picture, a Digimon, Tvia's feedback, blogger, and a researcher's personal comment. To which degree these elements mattered in what was going on is difficult to say. But they were *there*, and they contributed to the performance of Femtedit as a process of *continual transformation* of what was in focus and important. Continual transformation is a consequence of the pattern of elements coming together one after the other, just as it is another characteristic of the fluid pattern of relation. Building blocks erected, statements written in blogger, links added to the online 3D virtual environment. Now it was a film, then it was a granite wall, then it was the Femteditian's feedback. Then it was something else. Indeed, what the online 3D virtual environment *was* continually changing. Nothing stayed as it was—apart from the ongoing transformation. Stability of a fluid pattern of relations is not generated by fixed relations—as in network pattern of relations—but by continuous transformation. A fluid pattern of relations is variable in the sense that it does not collapse if objects are substituted by others, changed or disappear. On the contrary, fluid patterns are dependent on including new elements. They encounter their limits the moment they no longer absorb their surroundings. Indeed, the online 3D virtual environment displayed the characteristics of the fluid materiality. Through the arrangement described a pattern was formed which allowed the virtual environment to relate to the other involved entities by way of little recurring interventions, ongoing adjustments and gradual rearrangements. [36]

The temporality of the fluid materiality of the online 3D virtual environment was different from both the atemporal time of the regional materiality, and the provisional time of the network materiality. The fluid materiality was defined by its ongoing transformation, and thus time was a key constituent element of the online 3D virtual environment. Exchange of hyperlinks and building blocks in the virtual environment could only happen with the intervention or co-constitution of an *extended, continuous* time. MOL and LAW (LAW & MOL, 2001; MOL & LAW, 1994) describe fluidity as continuous transformation. This indeed characterized the materiality of the virtual environment. It implied an infinite time that ran and ran on forever, and with which objects could be exchanged and their interrelations could vary and thereby create ongoing transformation. [37]

7. Time of Materiality

I have described the materiality of three different objects: a regional blackboard, a network bed-loft and a fluid virtual environment. This description of the objects as each having a different materiality may lead to the misunderstanding that these are essential properties of the objects. As I have shown elsewhere (SØRENSEN, 2006), the particular ways in which objects contribute to performing materialities vary with the assemblage they are part of. Thus, the online 3D virtual environment also—in different arrangements—took part in performing a network materiality. This does not mean that any object can contribute to performing any kind of materiality. Consider the three objects described above. None of them

could replace any of the others with the same result of regional, network and fluid materiality, respectively. We do not have to do with social constructions that can be formed in any way—"out of the blue." We have to do with material relations that even though they gain their materialities through their assemblages, they cannot be formed randomly. [38]

Comparing the three objects in terms of materialities, we realize that a crucial characterizing difference between the three consist of their different *temporalities*. The network materiality embraces a temporality of the rise-and-fall of the materiality, describing the establishing and vanishing of the materiality (although the latter is rarely discussed in the literature). The temporality of the network was progressing as a life-circle. It had a temporal horizon, a vanishing point, while the temporality of the fluid materiality of the virtual environment was stable and continuous, compared to the regional materiality, which performed time as irrelevant, nonexistent.

Materiality	**Time**
Regional	Atemporal, no time
Network	Temporal horizon, lifetime
Fluid	Infinite, continuous time

Table 1 summarizes the different times of the different materialities [39]

8. Conclusion

I have expressed my dissatisfaction with the absence of a clear definition of materiality in Science and Technology Studies albeit this notion is so central to the contemporary discussions within the field. Due to the relational character of ANT, which is described as the most sophisticated theory within STS (SISMONDO, 2004), I have argued for a relational definition of materiality—as the formed pattern in which a particular entity takes part and which allows it to relate in particular ways to (an)other particular entity(entities). Understanding materiality as relational I argued that it must be studied in spatial terms. Relations may be seen as extensions between entities, which thus constitute spaces. With this vocabulary I described three different materialities: regional, network and fluid. Through the spatial descriptions time appeared as defining the distinctiveness of these three different materialities. While social science traditionally understands actors as moving in a relatively stable space through a linearly progressing time, my analysis has allowed us to see how entities come together in different material spatio-temporal formations. This was done by introducing materiality as patterns that makes it available for entities to relate in certain ways. Conducting empirical analysis with a focus on relational materiality instead of taking a point of departure in a pre-given grid of time and space the researcher's sensitivity is thus tuned to comprehend space as well as time as materially emergent phenomena. The material approach to time presented in this article is thus a way of reaching beyond the notion of time as running "naturally" as a background condition or

stable context (or space) for practice, and a suggestion to understand time as an emergent aspect of materiality, which in turn becomes characteristic for particular materialities. [40]

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