

Estrid Sørensen

**Fluid design as technology in practice –
Spatial description of online 3D virtual
environment in primary school**

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Fluid design as technology in practice – spatial description of online 3D virtual environment in primary school¹

Estrid Sørensen, University of Copenhagen

This article explores the use of spatial metaphors inspired by ‘After Actor-Network Theory’ in describing technology in practice. The spatial metaphors are developed mainly by John Law and Annemarie Mol (Law & Mol 2001; Mol & Law 1994; Law 2002). Active Worlds is the technology to be described. It is an online 3D virtual environment application, which I have used in a research project with a Danish and Swedish 4th grade primary school class. Describing this design in spatial terms, I characterize it as a *fluid* design. This metaphor is developed to create sensitivity to the transformative and flexible qualities of technology. Indeed, it can be traced back to Foucault’s attack on the ‘castle of coherence’ (Philo 2000), I argue. However, there are other ways technology is performed. I describe low-tech materials in classroom practices, and characterize them as *regional*. This is another spatial metaphor, which is useful to describe the stiff and immutable practice the classroom materials contribute to performing. I present two examples from my fieldwork, which show the limitations and problems with *authority* and *knowledge* arising as an effect of the confrontation of the fluid technology with the regional patterns of the school. I conclude the article by discussing the potentials of fluid design in a primary school practice to suggest changes in forms of authority and knowledge, just like I argue for the potentials of spatial metaphors for describing technology as it emerges as a dispersed effect in practice.

1. Online 3D virtual environment design

1.1. Online virtual environments

Online 3D virtual environments are graphic versions of Multi-User Dungeons (MUDs) (eg. Bruckman 1998; Pargman 2000; Turkle 1995). MUDs are text-based environments on the Internet usually build up as ‘rooms’. When the user enters a room he will get a description of the room. For instance:

A heavy door slams behind you. You feel the intense heat from the fireplace across the room. The large wooden table in the middle of the room is set with two porcelain plates, silver cutlery, and tall crystal glasses filled with a dark red liquid that looks like wine.

It is now up to you to act. Acting in a MUD happens by typing a command. The command will allow you to for instance drink the wine, go to the fireplace etc. Depending on how the MUD is programmed, some of the actions will result in an additional text passage telling you that the landlady enters the room and throws you out after drinking her wine. Or that

¹ I would like to thank professor Werner Rammert and scholars at the Technology Studies Research Group and the Forschungscolloquium at the Department of Sociology at the Technische Universität Berlin for comments and critique, which helped me shape the argument of this article.

you find a golden ring under a piece of firewood. Etc. Each step will make you move on to another, and little by little a story unfolds, which you are yourself taking part in authoring. Since the MUD is on the Internet, you will have a chance to meet other MUD users, who like you are part of the story, and with whom you can interact and chat.

While MUDs are text based, online 3D² virtual environment are mainly graphic. But instead of reading a text about how the room looks you will in the online 3D virtual environment see the room (or landscapes etc.) on the screen. And like in MUDs you will be able to act within the world and interact with other online user in the virtual environment. An important difference between MUDs and online 3D virtual environments is however that the latter do usually not have databases storing information about users' actions. Hence, spending resources like money, strength etc. may be programmed to have consequences in a MUD, while this does usually not matter in an online 3D virtual environment. Without any further design online 3D virtual environments hence provide less resources for creating narrative courses of events than MUDs, and is therefore often used as advanced graphic chat rooms.

During the 90'es several online 3D virtual environments were developed. Among these were Blaxxun Contact³, Active Worlds⁴ and Worlds⁵. Adobe Atmosphere⁶ appeared in a beta version in 2001 but was discontinued in December 2004 due to market conditions and customer feedback. The current research project concerns Active Worlds.

1.2. Active Worlds

Figure 1 shows two screen shots of the Active Worlds virtual environment browser.

2 Like is common I call Active Worlds virtual environment technology *3D*, even though it is not based on 3D graphics, but rather the so-called 2½D images, which are computer images that display apparent 3dimensionality, and that can be rotated on the screen.

3 <http://www.blaxxun.de>

4 <http://www.activeworlds.com>

5 <http://www.worlds.com>

6 <http://www.adobe.com/products/atmosphere/main.html>

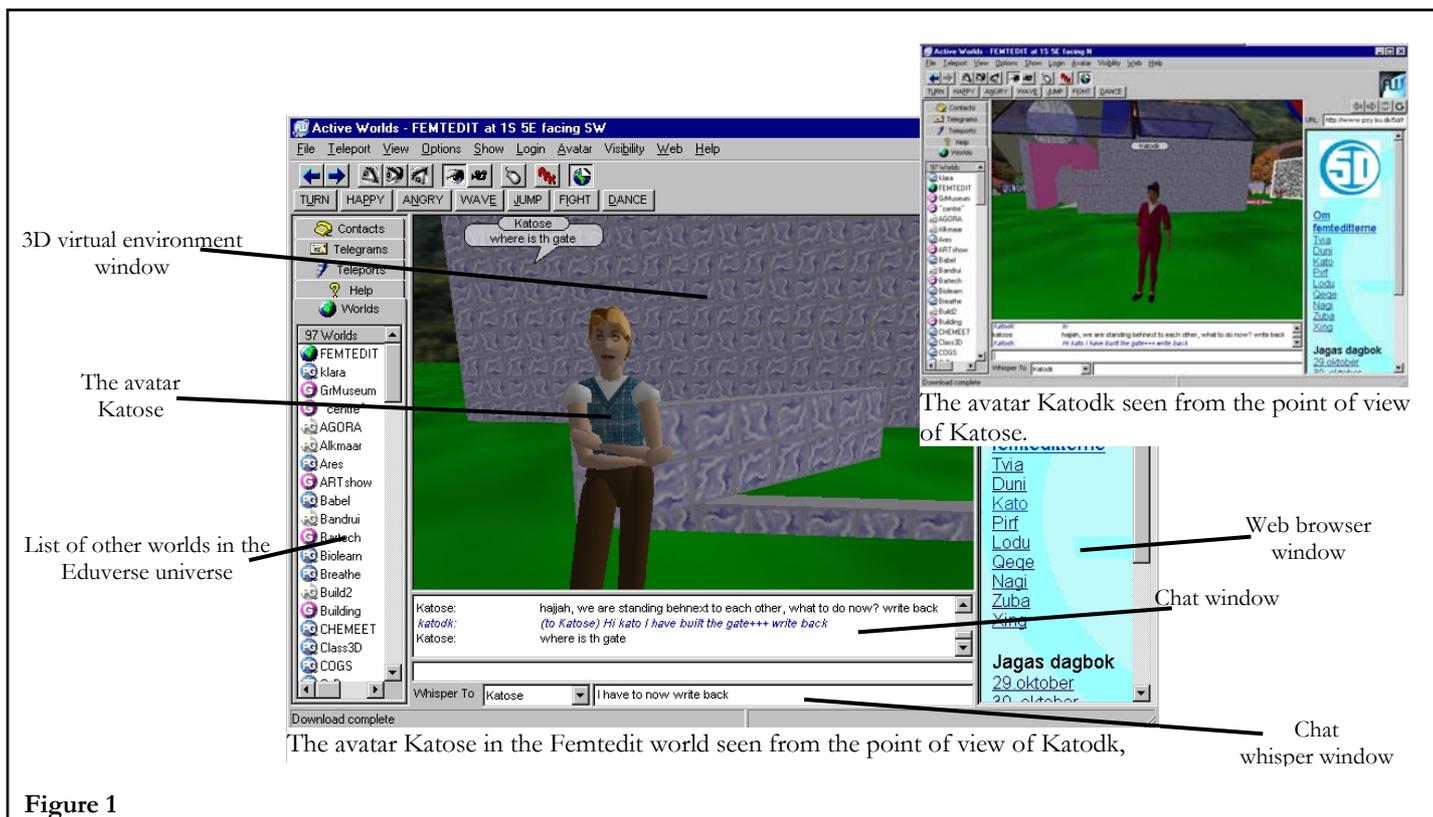


Figure 1

On each screen shot you see an *avatar*, a little graphic figure, which the user can move around in the virtual worlds using the mouse or arrow keys. There are app. 25 different avatar appearances to select between. The avatars can travel the present virtual world as well as the 57 other virtual worlds of this particular *universe*, listed in the ‘worlds’ window to the left of the graphic window. Since this 3D virtual environment is *online* users can meet avatars controlled by other users in the virtual environment. The screen shots in figure 1 each shows one of two avatars standing opposite each other, one controlled by a child in Sweden and one by a Danish child. Users can communicate verbally via chat messages that appear in the chat window below the graphic window, and above the head of the avatar. Asynchronous communication is possible through a ‘telegram’ function.

Apart from looking at other avatars, making gestures, chatting and moving around in the online virtual environments (partly through self defined teleports), one of the characteristics of the Active Worlds virtual environments is that users can build in the virtual world. Active Worlds places app. 2000 *building blocks* – walls, sofas, trees, fire extinguishers, water etc. – at the users’ disposal. Apart from arranging building blocks users can define colours and textures, animate objects (make them move, disappear when touched, flash etc.) and with additional tools create new building blocks and avatars. Furthermore, it is possible to put in jpg images and audio files in the virtual environment, which can be constantly visible or audible or appear by specific commands.

Finally, Active Worlds has an integrated web browser, which is located to the right of the graphic window. When adding a URL to an object in the virtual environment, the web page will appear in the web browser when the object in question either appears in the visual field of the user, is clicked on or bumped into by the avatar. It is also possible to close the built in web-browser window and let the web sides appear in an external web-browser.

The research project from which this article reports posed the quite open explorative question: What are the potentials of Active Worlds in a primary school practice? Active Worlds is used for many purposes: educational, research, entertainment, storage space, memory aid etc (Dickey 2003; Maher et al. 2001; Ligorio & van der Meijden 2001). This is possible because the virtual environment at the same time offers a wide range of functions *and* is quite undefined. Whatever practice Active Worlds takes part in it becomes something different. Not simply, I suggest, as a ‘social construction’ (eg. Pinch 1989), but because it needs to be configured to fit to each specific practice. As a consequence, I regard the study of Active Worlds as being necessarily a study of *a particular design* added to the graphic objects, digital functions etc. A study of the potentials of Active Worlds’ online 3D virtual environment *in general*, abstracted from any *particular* practice would from this perspective not make much sense. Accordingly, the next section will describe the particular Femtedit design that was added to the virtual environment in order to make it work as a research object and a material for a primary school practice.

1.3. The Femtedit design

Together with a research group at Blekinge Technical University⁷, we⁸ engaged a Swedish and a Danish 4th grade school class, and told them the following story:

On the Internet is a virtual world called *Femtedit*. Its citizens are the *Femteditians*. They come into being as a result of program errors on the server hosting their virtual world. When they arrive in Femtedit they are curious, but empty. Soon they start building a home and surfing the Internet, and from their homes they make links to web pages they have visited. This fills them up. As an effect of building their homes and linking to web pages, they build up their identities. A Femteditian’s identity is identical with the complete content of the web pages they have linked to.

Everything was fine in Femtedit until the day a virus attacked the server. Slowly but unmistakably, the buildings in Femtedit disappeared and with them the links. The Femteditians’ identities were deleted. Eventually the virus was cleaned away, but Femtedit had almost vanished, and the Femteditians had become empty like zombies, unable of doing anything at all. Including saving their own world. Just in time, however, the youngest of the Femteditians, Jaga, managed to write to the researchers asking for help to save Femtedit by building up new homes and reanimate the Femteditians by making hyperlinks from their homes. The researchers realised this was a major task, gathered a Danish and a Swedish 4th grade class, explained the whole story, and entrusted them the rescue operation.

The frame story, however, was not only spoken words. We built up Femtedit as ruins of the late Femteditians’ homes, which contributed to telling the frame story. Furthermore, the story was written as Jaga’s diary on the Femtedit web site⁹. This frame story was constructed in a way that it included as many of the functions of Active Worlds as possible: travelling the virtual environments, building – including potentially animation, picture and audio installation, etc. - verbal linking to Internet pages and communication. Communication was made necessary through a specific organisation of the children. They were organised in groups whose members worked at different times and across national boundaries. Such an organisation requires of its participants that they articulate their distributed individual activities (Schmidt & Bannon 1992 p. 8; Star & Strauss 1999 p. 10).

7 Mainly with Carina Anderson and Rosita Anderson from Learning Lab.

8 The Copenhagen research group consisted of Nina Armand and Kenneth Jensen from University of Copenhagen and Tine Jensen from Roskilde University.

9 <http://www.psy.ku.dk/5d/femtedit>

To facilitate such articulation work we set up a web log¹⁰ for each group. On this Internet application, which was at any time accessible by any member of the group they could note what they had been doing, and which they saw as the next steps. Their messages would stay visible in blogger and could be viewed by other group members.

Because Active Worlds consists of a wide range of tools, it invited to a quite open-ended practice, which the design of Femtedit also performed. A practice, which would change over *time*. Thus, time also had to be taken into account in the design. Blogger was introduced as a crucial technology for this purpose. As the Femteditians were gradually reanimated, they would communicate to the children through blogger. They would ask if the link to a mobile phone web site was really the only aspect one needed in life, or in other ways comment and challenge the links the children had given them. In the beginning these challenges would be about the individual identity of the Femteditians. Later comments would also regard social relations, questioning the appropriateness of some hyperlinks in relation to links of the Femteditian's neighbours. This way, the story built on a frame of development over time.

It was the researchers and teachers involved in the project, who wrote the feedback form the Femteditians in Blogger. During the sessions with Femtedit in the schools, we observed what was going on in the Femtedit, and after the sessions we wrote field notes, which were uploaded to a closed discussion forum on the Internet. After reading each other's field notes, we discussed on the background of these data of what had happened at the previous session, what would be the relevant next feedback from the Femteditians. In order to make Active Worlds a combined research and school technology we did not only have to entangle it with research teams and two 4th grade primary school classes. Active Worlds was *translated* (Callon 1986) by and through a frame story, a social organisation, web logs, and a research forum. This does not mean that it was no longer Active Worlds. Like any other performance of Active Worlds, Femtedit was a specific *version* (Despret 2004 p. 22ff; Mol 1999; Mol 2002) of Active Worlds.

1.4. Femtedit – fluid design

Borrowing a *spatial metaphor* suggested by among others Law and Mol (Law & Mol 2001; Mol & Law 1994; Law 2002; Laet & Mol 2000) I will characterise the version of the online 3D virtual environment Femtedit as *fluid*. I shall discuss spatial metaphors further below, and here just describe in what ways Femtedit fits the metaphor of fluidity.

This version of the online 3D virtual environment had the fluid quality of *transforming gradually*. The frame story set the activity in motion, but as the project went on, the frame story changed. It was initially about recreating Femtedit and reanimating the Femteditians, but as new elements in the form of building blocks, links and descriptions in blogger were added, as Femteditians questioned the new elements and links were supplemented or exchanged by others the online 3D virtual environment changed its character. The visual appearance of the online 3D virtual environment changed as well as its contribution to the practice and its openness to intervention. When buildings were constructed in certain ways and certain links were made these initiated a path, a direction of the process, which would make it more likely for some new building blocks and links to be added than for others. At any point in time, this version of Active Worlds would be something different. It would transform gradually.

10 <http://www.blogger.com>

The second fluid characteristic of Femtedit was that it *involved elements from outside*. One girl brought audio files of Pakistani music, linking them to the house of her Femteditian. A boy found an image of a character knew from Cartoon Network, and put it in his house. A twin couple built the twin towers of New York linked to satiric anti-terrorist web pages. As the time went on, it got increasingly difficult to separate the ‘inside’ and the ‘outside’ of Femtedit. The *boundaries* of the online 3D virtual environment *blurred*, which is another characteristic of fluid forms. Every new link, every new sound and image in Femtedit contributed to transforming the online 3D virtual environment, while at the same time maintaining it as the ongoing process it performed. The *gradual transformation*, the *blurry boundaries*, the *unstable relations* and the *exchanging* and *optional character* of the elements involved are the characteristics that make it fit the metaphor of fluidity.

2. Spatiality

2.1. Spatial descriptions

It may be obvious that characterising a technology as fluid allows us to describe technology differently than the commonplace description of technology as stable, robust and well defined. This is the advantage of the fluid metaphor. However, there is more to it than that. In this section I shall provide some background to spatial thinking – and especially what is *spatial* about it – and in the next, I shall present one additional spatial metaphor.

Let us travel back to Michel Foucault. Chris Philo explains Foucault’s endeavour as a critique on what he called total history. Characteristic of total history is that it

“...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”
(Philo 2000, p. 210)

We do not deal with history. We deal with technology. But technological descriptions are indeed often marked by a similar homogeneity, smoothness and generality as Philo describes characterises total history. As an alternative to total history Foucault suggest what he calls general 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 1979 p. 10)

Foucault is far from the only one in social science criticizing singular and purified descriptions (see eg. Miller & Slater 2000; Haraway 1991; Lave 1988). But his solution about *deploying the space of a dispersion* is unusual. Contrary to establishing a point from which one can get a total overview over the object of study as a whole, comprehensive entity, it suggests that we take a point of departure in a *particular* object and look at the *relations* it is entangled in. What is to the left of it, what is above, what bumps into it, what stops it etc. This is the *spatial* character of the description. It is produced by following one object¹¹ after the other along their mutual relations, and thereby step by step describing the space this particular arrangement of objects performs or deploys. Instead of trying to

¹¹ I use *object* as more or less synonymous with *something*. It does not refer specifically to what we usually know as *things* as opposed to subjects, something *tangible* as opposed to ideas, nor to a target or goal. Spatial descriptions can just as well involve humans as non-humans, tangible as well as non-tangible. As a term referring to all these non-categorised materials, I talk about *objects*.

describe the object of study relative to a principle, a meaning or in any way to a *singular* point, Foucault's spatial approach describes the distribution of objects *relative to one another*. Described this way, the object of study *is* the space it performs.

A description of a technology in spatial terms is hence a description of how the technology is performed through and by the dispersion of objects. Since this is a quite abstract imaginary, I suggest instead talking about *pattern of relations*. Characterising a technology by following the objects as they relate to each other, what we come to describe is the way they relate, the way they interact. The pattern these relations form. Their pattern of relations. Going back to our online 3D virtual environment, we realise that the fluid metaphor highlights the pattern of the relations between building blocks and frame story, children, researchers and hyperlinks. The ways in which links and building blocks were related to the feedback in the blogger, the frame story and range of digital tools they as an assemblage performed gradual transformation. Just like the links and their relations to web pages blurred the boundaries of the online 3D virtual environment.

2.2. Spatial metaphors

To help us think about spatial performances – patterns of relations in my terms – Mol and Law have developed a number of spatial metaphors: fluid, region, network and fire (Law & Mol 2001; Mol & Law 1994; Law 2002). Apart from the fluid metaphor, which I have already introduced, and which I will return to shortly, I shall here only discuss one other spatial metaphor: the *region*.

Let me give an example. Parallel to my study of online 3D virtual environment in primary school, I did participatory classroom observation (inspired by Hammersley 1980; Christensen, Pia H. and James, Allison 2000) in the Danish 4th grade primary school class looking at how learning materials took part in the interaction in a conventional classroom. The blackboard, I realized, was a regional technology. Or put more precisely: A technology that in its specific version in a conventional classroom setting, contributed to performing regionality. Writing on the blackboard created a visual field, which attracted the attention of pupils to what was going on on it. What was written on the blackboard could be seen by all children at the same time. This made it important. And because what was written on the blackboard could be witnessed by all pupils it also gained authority.

T: David, will you read out your speech for us?

D: I didn't know I had to bring it

T: But it was written on the blackboard...

What had been written on the blackboard was official and could be referred to as such. Contradicting the statement about what was written on the blackboard meant turning against the perception of everyone else in the class.

Most of the time the authority provided by the blackboard was associated with the teacher. She was the one who was directly allied with the blackboard through the chalk. It helped the teacher performing authority. Thereby, it contributed to separating the teacher from the pupils. Being a large visual area in the classroom, it did so by creating a spatial region in the classroom to which authority was assigned. The blackboard, however, was not exclusively associated with the teacher. Sometimes, a pupil was called to the blackboard. When she moved from the pupils' region to the blackboard to read a text out loud for instance her voice gained attention from all pupils in a quite different way than when she stayed at her desk. And it happened frequently that a pupil's presentation at the blackboard was followed by applause, which never happened as a reaction to a presentation given from

the pupil's desks. Moving her body from her desk to the blackboard she crossed a boundary between the region of the rest of the class and the region of the blackboard. She went 'up' to the blackboard, they said, and when finished, she could go 'down' again. There was a *clear boundary* between the two regions. The region of the blackboard was saturated with authority, with drawing attention to what was said and done, and to the individual who said and did. In the region of the rest of the classroom it was possible to say and do a lot without anyone paying particular attention to it, without it gaining authority. Even though pupils could cross the boundary to the blackboard region, it was clear that they were 'guests' here, which for instance were indicated by always being explicitly permitted access to this region and by applauses following a presentation at the blackboard. The teacher was never applauded. Hence, the boundary between the blackboard region and the region of the rest of the classroom was a boundary *separating* the teacher from the pupils.

Furthermore, each region was *well-defined* and *homogeneous*: The teacher could from the blackboard region communicate with all 24 pupils at a time. This was possible because and this was how they were performed as one single, homogeneous region. This one-to-many broadcasting mode of interaction was performed by and as a regional pattern of relations.

The regional pattern of relations was performed through the visual materiality of the blackboard drawing attention to what was written on it and making all participants witnesses of the writing on the blackboard. It assigned authority to the personal performances at the blackboard, mainly the teacher's. It created the pupils as one unit – one region – and it allowed a broadcasting mode of interaction.

I have used the spatial metaphor of a *region* to describe this relationship. The metaphor is confusing, because it mirrors what we usually think of when talking about space. Which is part of the tricks of spatial metaphors. To emphasise that regional (or Euclidian/Cartesian) space is *constructed* as such, and that *other* spatial forms exists. Other patterns of relations. The specificity of the regional pattern of relations is that it creates regions delimited by clear-cut boundaries, which separates regions of well-defined and homogeneous identities, each *different* from that of the other regions.

The blackboard is a technology that contributed to creating two regions in the classroom with each their social norms, each their identities. Each of these regions were homogeneous, they were different from one another, and there were clear boundaries between them. Hence, the blackboard is a materiality that contributes to creating an *immutable immobile*; a socio-material entity, which creates a pattern of a stable and static structure. Technologies are often described like this: as patterns of relations that do not change over time and space. What they are is not influenced by *where* they are, just like they over *time* stay the same. There is no *time* involved in the description of the blackboard, there is no transformation in the pattern of relations it contributes to performing, like we saw with the pattern of relations performed with the online 3D virtual environment, which I characterized as fluid. The project of Actor-Network Theory (ANT) (eg. Latour 1988) is very much to challenge theorising in regional terms. Regional theorising can for instance mean setting clear boundaries between technology and humans as separate and ontologically different entities each with homogeneous identities, and as a result of a study sorting out the objects of study in just as clear-cut, separate categories, which are claimed to be universal, beyond time and space. By introducing the network metaphor Latour (eg. Latour 1987) has suggested a different way of theorising about science and technology. A way emphasising that stability in time and space is not intrinsic to scientific facts or to technology. It is constructed. However, in different ways Lee & Brown (Lee 1994) and Strathern (Strathern 1996) the network metaphor for being all-inclusive, and Star (Star

1991) has pointed out its tendencies to managerial perspectives. This is not unlike regional theorising. As a contrast to this Law and Mol have in what has been called the *After-ANT* move (Law & Hassard 1999) presented spatial metaphors as *empirical* metaphors, which may help us produce empirical descriptions of different ways science and technology may be performed. Hence, the network metaphor is not an alternative to regional thinking. Both – and the fluid metaphor alike – are ways of describing ways in which science and technology may be performed.

3. Fluid design in practice

I shall in this section return to the fluid design of online 3D virtual environment I described in section one. I shall present two examples from my empirical research from a project with the described online 3D virtual environment in a Danish and a Swedish 4th grade primary school class. I shall compare what happened in the Femtedit project with what I experienced in the classroom during my participant observations. Both examples focus on problematic aspects of the fluid design on what I call *points of repulsion* at which the technology encountered difficulties in the process of interactions into school practice. I have chosen to focus on points of repulsion partly because describing limitations of a technology is an important aspect of describing a technology, partly because acknowledging the problems and conflicts a technology encounters is crucial for further developing the design.

3.1. No space for authority

The teacher moved restlessly around in the computer lab of St. Marc Street School, where I did my fieldwork. While the design of Femtedit assigned the space of the online 3D virtual environment to the children, the teacher's space was in the computer lab. However, there was no region for the teacher in the computer lab, like the region established in the classroom by way of the blackboard. There was no technology like the blackboard to draw attention to what she said, and which allowed the broadcasting mode of interaction and there was no assigning of authority. This was not due to the lack of a blackboard in the computer lab. Rather, it was because the fluid pattern of relations of the online 3D virtual environment was not able of contributing to establishing the authority as was the blackboard through a regional pattern of relations. Let me describe this.

The children's gazes were fixed to the computer monitors. So you could find pupils' gazes fixed to the textbooks in the classroom. In the classroom this did not prevent them from drawing special attention to the blackboard and to what the teacher said. Their gazes would easily travel from the books to the region of the blackboard. Like Steven Poole (Poole 2000 p.236) does it in his seminal description of the experience of playing computer games many scholars describe how players' attention is sucked into the computer due to the 'wonders' that happen on the screen. Studying the patterns of relations between the participating elements rather than looking at the computer and the child (or player) as separate entities that act upon each other, a different account emerges. I see no reason to conclude that the children did not contribute to performing the teacher's authority because they were spellbound to the screen. Their gazes could and did often travel elsewhere from the screen – to notebooks, to other children, to researchers and to the teacher. We need to

look at how the materiality of the online 3D virtual environment was involved to find another explanation.

With their hands on the mice the children moved the avatars in the online 3D virtual environment. They chatted with their Swedish and Danish partners, they built up the Femteditions' homes, and they added hyperlinks. The space in which the children did all these things was an extension of the computer lab. And the only way of knowing what was going on in this extended space was to look into a computer screen. But even when doing that, the teacher would not get any overview over what the children were doing. They were dispersed over an area that was far bigger than what you could see on the computer screen at one time. The teacher could follow what one or maybe a few avatars were doing when looking into a computer screen. But the virtual environment was far too big for her to get any overview over the whole world at a time.

This, I suggest, was the reason for the restlessness of the teacher in the computer lab. The teacher did not have a region from which she could overview another, homogeneous region. She could not broadcast; she could not communicate one-to-many. And hence the pattern of relations was not available which in the classroom contributed to establishing authority. The online 3D virtual environment was too large for her to *reach* all other the avatars¹².

Reaching is a necessary precondition for establishing and maintaining authority. But it is not sufficient. *Prediction* is also necessary. Being unable to reach all children from one region, the teacher walked around in the computer lab, looking into one computer screen after the other. She gained a serial one-to-one relationship with the children contrary to the one-to-many relationship performed with the blackboard in the classroom. A serial one-to-one relationship was also at times performed in the classroom. Frequently, the children worked individually with their exercise books while the teacher wandered around from pupil to pupil, talking with one about the exercises he or she was doing, and after a while moving on to the next. This apparent one-to-one relationship however was at the same time a one-to-many relationship. The teacher knew the all exercise books and even when turning her back to a pupil, she would be able to predict quite precisely what the pupil would be doing the time following¹³. By being almost identical¹⁴ all the exercise books together

12 It is important here to understand 'reaching' as an interactional achievement. The teacher could technically give messages to all children by sending a message via chat, but such a message was seldom if ever received by all children, because they were busy with so different things, and the message given would hence often not make sense to what many of the children were doing. Thus, the message did not reach them.

13 Of course, pupils often did other things that what they were supposed to in the exercise books. They chatted with classmates, drew doodles in the exercise books, fumbled with the pencil case etc. This required quite a lot of repair work by the teacher in order to maintain the regional order. This however, does not change that the exercise books contributed to performing a regional pattern of relations with the implications I have described. At times it did happen that other patterns would *undermine* the regional pattern of relations, when for instance a leaf of the exercise book was torn out and used to making a paper dart. It is however beyond this article to discuss these subtleties of patterns of relations (for further discussion of this see Sørensen (Sørensen 2005) and of intertwining of spatial forms, see Law (Law 2002).

14 When I went to school in the 70'es all exercise books were the same. Since then, however a new aspect has come to the centre of educational politics and is emphasised in curricula and has changed learning materials. It is in Denmark referred to as "differentiation of education", which means that every pupil has to be treated according to his or her needs and abilities. In the exercise books this is realised by making them more or less difficult. In the Danish exercise books of the class in which I did my field work, all exercise books were in principle the same. The tasks were to fill in words on empty spaces in the sentences. For instance: "This ice cream is big and tasty, but that one is even bigger and even tastier". The underlined words would be excluded from the sentence, and the pupil would have to fill them in on empty lines. In some exercise books – for the most skilful pupils – both lines would be blank, while in the

performed one homogeneous region, even though each child had his or her own book. Being one region, the teacher could keep an overview over what all pupils were doing even when not occupied with them individually. This was partly – but not exclusively – because of the *constellation* of exercise books; they were all the same. Furthermore, it was only because of the regional immutability of the exercise books that she could know what the pupil would be doing in the exercise book even when she was not looking. Even though not standing at the blackboard she had a one-to-many relationship with the pupils. This was possible because of the regional pattern of relations of the individual exercise books and of the constellation of identical exercise books.

The online 3D virtual environment was different. As a consequence of its fluid character the children moved to dispersed places in the virtual environment, built different things, chatted and linked to Internet sites. What they did was far from the same. But the teacher did not only have to do with 25 children differently positioned and differently occupied. She also only very temporarily could follow what the individual child was doing. When she turned her back to the child, he or she could continue the activity by engaging in many different things. The fluid pattern of relations of Femtedim allowed the activities to turn in all sorts of directions. While the activities with the exercise book in the classroom was predictable due to the immutability of the exercise book, the online 3D virtual environment was changing continuously, which rendered predictability impossible. Furthermore, the exercise books were all the same while the children's' activities in Femtedit were quite diverse due to the continuous changing of the online 3D virtual environment. The authority the teacher gained in the classroom due to the regionality of the learning materials could due to the fluid pattern of relations of the online 3D virtual environment not be performed in the computer lab.

3.2. No representational knowledge in fluid space

Apart from the problem that authority could not be performed with the online 3D virtual environment, there was also a problem of knowledge. My attention was drawn towards this by the teacher. Half way through the project she was not too happy about what was taking place, which she expressed by stating that what the children were building “didn't resemble anything”. She would have preferred, she said, if the children had build a model of a Viking village like the one they had visited in the open-air museum in Lejre.

Again, I turned to the learning materials in the classroom to compare them to the virtual environment. Many of the materialities in the classroom did involve resemblance. These were textbooks, maps, drawings, etc. They all *represented* something somewhere else. An example took its point of departure in the math textbook.

The teacher is standing next to her desk with the textbook in her hand, reading out loud

T: “4th B are doing physical education. Today they are on the athletics pitch. They do long jumping. First, it is Jens's turn. He runs as fast as he can and jumps. Mette is the linesman. She takes out the tape measure and measures his jump: Two meters”.

The teacher looks up from the book.

T: Two meters – is that a long or a short jump?

Three children put their hands in the air. Kim doesn't.

T: Kim – two meters, is that a long or a short jump?

Kim looks bewildered at the other pupils at his desk, but no one comes to his rescue.

K: Short... [low voice]

The teacher walks towards the blackboard

T: Well, Kim... let's see...

textbooks for the less skilled there would only be one empty space.

She takes a piece of chalk and a big one-meter ruler down from a hook in the wall. She turns around and walks towards the middle of the classroom.

T: Come here, Kim.

Kim walks over to her.

T: Ok, stand here....

The teacher draws a chalk line on the floor. Kim looks at it and shuffles his feet. The teacher walks backwards towards the blackboard.

T: So... just stay there.... Kim, now jump from that line ahead as far as you can.

Kim looks at her, looks back at the chalk line, takes a step back and jumps ahead with great effort.

T: Stay there, stay there...

The teacher grabs Kim's shoulder. She bends down and draws a chalk line on the floor where he stands.

T: Ok, Kim. Let's see how long you jumped. This ruler is one meter long.

The teacher puts the ruler on the floor and measures the length between the two chalk lines.

T: Ninely.... three centimetres.... Almost one meter... You jumped 93 centimetres. Not too bad. So... what do you think? Jens jumped two meters. Was that a long or a short jump?

K: Long.

T: That's right, Kim. Two meters is quite a long jump... Now you can go back to your seat.

The one-meter ruler is a standard allowing the teacher to compare Kim's jump to Jens' jump. Applying an almost scientific experiment, the teacher compared two entirely different activities by referring to a standard measurement. The truth about the Jens' jump is performed as lying in the standard. Kim could have known the answer beforehand – without the jumping and measuring – had he known the standard better. But because he did not an experiment was established to reveal the truth about the jump. After the experiment was over there was only one short, pure knowledge about Jens' jump: Long. The ruler, Kim's bodily efforts, the chalk lines etc. were all discounted just like Latour (Latour 1987) notes that an experimental set-up is discounted *after* the experiment and only the purified result of the experiment is taken into account as the knowledge. Kim's jump and the teacher's measuring of the jump were performed as mere *demonstration* of the length of the Jens' jump. The truth about the length of the jump lay *not* in the material activities of the classroom, but in the standard. The standard, which was beyond the classroom. It was somewhere else. This way knowledge was performed as referring to something located elsewhere. As representing something somewhere else. In this case the knowledge *represented* the standard.

The pattern of relations this *representational knowledge* performed is *regional*. It performed knowledge as a region in the head of the pupil – or in the textbook, in images etc. – which was clearly delimited and separate from the object it represented. Two distinct regions were performed, one mirroring the other. In order for this regional pattern to be performed, the two regions had to be stable. The length of Jens' jump was noted in the textbook, and due to the materiality of the printing ink, it would not change. It was immutably two meters long. The chalk lines on the floor in the classroom were erased after the experiment, but in the moment of measuring they performed a constant distance. Even though the teacher held a hand on his shoulder Kim's shuffling feet may not have ensured the necessary constancy for making an immutable measurement. When measured the other pupils witnessing the experiment would ensure the constancy of the length of Kim's jump¹⁵.

Let's return to the online 3D virtual environment. It didn't resemble anything, the teacher said. It didn't represent anything. Indeed it didn't. The teacher preferred the building of a model of a Viking village. A model that could represent the Viking village in open-air museum in Lejre, which represented a 'real' Viking village. The Femtedit version of the online 3D virtual environment did not contribute to performing representational

15 Compare to Shapin & Shaffer's (Shaffer & Shapin 1985) description of the witness as a crucial element in the scientific experiment.

knowledge. Which was the teacher's complaint. I did mention above the building of the Twin Towers in Femtedit. However, they were not a model of the late buildings on lower Manhattan. Satiric anti-terrorist websites were linked to them as well as images of bombs. Thereby they did not *mirror* the 'real' Twin Towers, but *built on* them, integrating a historic event as resource for their own endeavours. The pattern of relations performed with the Twin Towers in Femtedit was not regional representing the late Twin Towers on Manhattan, but fluid, involving elements from outside. Secondly, like most of what else was going on in Femtedit, the Twin Towers were continuously transformed. New links replaced prior ones, new building blocks, images, sound etc. were added.

This fluid pattern of relations performed with the online 3D virtual environment did not leave any space for regionality, and hence for representational knowledge. We might describe the knowledge performed as *non-representational*, which in Thrift's (Thrift 2000) terms resonates fluidity described as a 'ghost' of an external object (or subject) appearing 'between the lines' of a performance.

4. Conclusion

Using spatial metaphors I have described a specific design version of Active Worlds' online 3D virtual environment as fluid. Focusing on the *points of repulsion* between this technology and the school practice in which it was set to work, we have seen the ways in which it becomes difficult to integrate a fluid technology in a school that to a wide extent and through a variety of technologies performs regional pattern of relations.

More than seeing technology and school practice as mismatches I have identified the different patterns of relations the online 3D virtual environment and the conventional learning materials contribute to performing. Focusing on the differences in patterns of relations the analysis has opened for an analysis of how authority and knowledge may be *other* than *regional*. I stated there was no space for authority in the fluid pattern of relations performed with the online 3D virtual environment. This however only applies for authority in *regional* terms; authority constituted as a clear separation between the authority and the subjected, and with clear boundaries between the two. A pattern of relations in which authority can be exercised due to having an overview over and to predicting others' behaviour.

We might however think of authority in a fluid pattern of relations. Here, authority – understood as what exercises abundant influence on others – may be constituted as authority of the preceding step. Since fluid patterns of relations transform gradually, they always take only one step at a time away from the preceding. A regional pattern of relations may imply large jumps between regions – between Kim jumping in the classroom and Jens' jump reported in the math textbook. Contrary to this, the online 3D virtual environment preceded by adding a link, a building block, an image, a sound to the existing ones. Nothing could be connected to the existing without being a direct, concrete link. There were no standards that might bridge distant elements. Hence, the existing, the last step in the ongoing gradual transformation of the fluid pattern of relations have authority over the next. Concluding this from describing the online 3D virtual environment design in spatial terms, we have been shown a direction in which to search for a solution to the problem of the teacher's apparent lack of authority. It is not, as would probably be a commonplace conclusion, to compromise the fluid design and create a region which could contribute to performing authority. On the contrary, it could be improving and developing tools for the

teacher to better exercise *fluid authority*. This could be by supporting the teacher in giving feedback to the children in blogger in a way that could better feed into the fluid process of the online 3D virtual environment. Feedback, which could connect to what children were doing, ensuring that the children would pick up on it and integrate it as elements in the ongoing transformative process of fluidity. The potentials of a fluid pattern of relations in a (regional) primary school setting is hence to contribute to new ways of performing authority, as well as knowledge.

Finally I would like to draw a few conclusions about describing with spatial metaphors. The advantage of this method of describing is its ability to show how technology connects with practice – to put it blunt – and how it doesn't. I understand the focus on the patterns relations between objects perform as a focus on *materiality*. It is a way of describing *in particular* how different materialities connect – human, non-human, tangible, ideal etc. By applying spatial metaphors, I have been able to describe different characteristics of different materialities. This allows for understanding technology not just as robust and stable over time and space, but also possibly as transforming and variable. By describing the different spatial patterns performed, it is possible to identify the modifications in *both* technology *and* practice that might allow a more 'artful integration' (Suchman 2002) of technology in practice.

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