

Posthuman Data Production in Classroom Studies – A Research Machine put to Work

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Abstract

This paper describes a methodological inquiry that explores ways of performing classroom studies, where posthuman theory and data production are plugged in to each other from the very outset of this effort. Posthuman theory insists on research practices that demand attention to materialities, research practices that seek to detach the investigations from human concerns and positionality, research practices that consider how data and researcher(s) are entangled producing each other and by that try to operationalize the 'unself' of the researcher(s). Hence, a research machine was constructed and put to work in one Physics classroom in an upper secondary school. Five researchers focused on various multiparty interactions, whilst attempting to background the interpersonal interactions. Subsequently, the research machine was plugged into different concepts and turned into workshops where changes in configurations became significant for emergences in the classroom. In this process the concept affraction emerged as an effort to map how material-semiotic processes become observable in classrooms. The work of the research machine points to possible ways of avoiding commonly privileged perspectives in classroom observations. This attempt to deconstruct boundaries between human and non-human and the human as a bounded non-porous subject may affect possibilities to produce research that aids what otherwise might be shadowed actions in classrooms.

Keywords: posthumanism, Deleuze & Guattari, qualitative data production, research machine, configuration, classroom studies

Posthuman Theory and Data Production

The construction and work of the research machine in focus for this article have emerged from engagement with the post-qualitative turn, new empiricisms and posthumanism (Taylor & Hughes, 2016). In educational research, posthumanist research practices engage a radical critique of some of the fundamental assumptions underpinning the dominant ways of doing educational research (Taylor, 2016). Posthumanism proposes different starting points for educational research, and new ways of grasping educational experiences, than those afforded by human centered theory and methodology. Compared to the dominant humanist paradigm, posthumanism takes its starting point in problematizing a different set of onto-epistemological presumptions about the forms of knowing and being through which humans and nonhumans inhabit the world (see e.g. Lather & St. Pierre, 2013; St. Pierre, 2011). Posthumanism includes the ‘others’: nonhumans, other-than-humans and more-than-humans, that humanism, but also poststructuralism and postmodernism, exclude (Taylor & Hughes, 2016). When trying to go beyond understandings of “the-human-aspects” of the world in educational research, it changes the parameters of conducting such research. The parameters are changed through thinking relationally with other beings/matter and by the recognition of their vitality and agency. Bennett (2016) points out that posthumanism exhorts us to pay more attention to nonhuman things, it pushes us to engage more ‘deeply’ with non-sentient objects, and in ways that detaches our investigations from human concerns and positionality.

But, how does, if it is even possible, one study classroom practices without privileging agency of the human agents in the room? How can a study be performed that considers the relational agency (between all entities)? What sorts of ‘data’ can be produced and how might they be analysed? In turning to these questions, some posthumanist researchers have problematized the dominant codes of contemporary research as well as data itself (Davies, 2014; Lather & St. Pierre, 2013; Mazzei, 2014; Ringrose & Renold, 2014; Rosiek & Heffernan, 2014). St. Pierre and Jackson (2014, p. 714) ask for example “what counts as ‘good’ and useful data” and points at “collecting data presumes we’ve already determined what counts as ‘data’”. In line with Barad (2007) they question the notion that there is a ‘reality’ somehow outside and untampered by the researcher(s), which can be collected, and set under scrutiny by following data collection principles, using research questions, perspectives and theories. Instead they insist that data and researcher(s) are entangled producing each other.

So, what we see is that posthuman approaches challenge traditional methodological views as they require us to decenter not only the human subject as central focus in the research but also take into account the co-implication of interdependency and entanglement of the researcher(s) and research apparatus, as an attempt to operationalize the ‘unself’ in research practices (Quinn, 2016). That is to move beyond the focus on the authentic inescapable or self-made self. An unself is never finished, it is always in transition as a condition of subjectivity, in permanent flux, seeking to free the limiting constraints of person hood. There is no fixating on fixed moments of change (Quinn, 2010, pp. 16-17). Thus, as subject-decentered as well as non-representational, post-human theory subverts not only conceptions of what is to be determined as ‘object of knowledge’, the connection(s) between the researcher(s) and other elements in a study, but also the character and claims that can be made (Lather, 2013; Masny, 2013).

Posthumanist studies in education often point at these theoretical implications and frequently stress the impossible action of distinguishing between the object for research and the subject in the form of the researcher (see e.g. Coleman, 2013; Jackson & Mazzei, 2012; Lenz Taguchi, 2013; Sørensen, 2011). Despite this, most posthuman studies in education seem to delimit posthuman theoretical perspectives to the analysis of data that has been produced by conventional ethnographic methodology such as participant observations (c.f. Sørensen, 2011), video-recordings (Mulcahy, 2012), interviews (Jackson & Mazzei, 2012), or narratives produced by students (c.f. Hohti & Karlsson, 2014). For example, when Sørensen (2011) suggests how to take account of the material in research, the data she uses for the study is conventional ethnographic field notes, i.e., data that tend to be

anthropocentric, produced by one human subject with focus on activities by other human subjects. Another example is Jackson and Mazzei (2012) who use traditional interview data from two first generation academic women and use the resulting transcripts as the data for analysis based on different theories and theorists such as Derrida, Spivak, Foucault, Butler, Deleuze, and Barad. Although Jackson and Mazzei acknowledge the centeredness of the human subject in this interviewing practice, they argue that by accepting in their research and in this case the conversations with the women in the study, that the data is partial, incomplete, and is always in a process of a retelling and remembering, this is not a problematic issue for them. Consequently, the way they analyze these data differ from the humanist position in that they refuse to create thematic patterns to represent the essence of the participants in their study. ”

Although Jackson and Mazzei (2012) definitely apply a posthuman approach in the analysis of the interview material to address their questions the fieldwork is rather conventional, which also Jackson (2016 ‘p.191) points at in her work ‘An ontology of a backflip’ where she writes, “I conducted “traditional” qualitative fieldwork in a different ontological arrangement,...”. The fieldwork as such is thus conducted in a conventional way, but in positioning it within a posthuman ontology, the data production comes out differently.

Consequently, we have found that most educational posthuman studies pull previously and conventionally produced data into a writing process where the entanglement of analysis and data production is argued. We appreciate this and benefit from all the effort done in posthumanist research focusing on how to put theory to work with data. But, we believe a further experimenting with how ‘method’ can be put to work with theory is needed. The view among the posthuman researchers is of course that the quality of data is not taken for granted, ‘but the practices of data production’ seem most often to by-pass the ‘working with theory’ part. This is at odds with the posthuman insistence on research practices that demand attention to materialities and affects. It is an encounter with the posthuman stance that prompt experiments and interferences with data production and an onto-epistemology where research, phenomenon and researcher are produced together. There are, however, exceptions to this. For example, in a study of computer software for registration of school absence, Bodén (2015) uses the Baradian inspired concept (Barad, 2003, 2007) “intra-view” in order to produce data on what emerges in relations between computer, interviewee, and interviewer. In these intra-views the agency of the computer is made equal to that of the human participant as well as the researcher. Bodén (2015) says that this is as an interruption of the traditional structure of the interview and a way to invite more than human agents to speak. This becomes an extended way to continue, and extend, a thinking in which the entanglements of human and nonhuman agents are central to the production of knowledge by interviews. Ringrose and Renold (2014) explore research processes as “intra-acting” also drawing upon Barad (2007) and they discover methodological practices using MacLure’s notions of data. They describe how “affective intensity” operate throughout the entire research process, not only within the discrete, objectified data bits and clusters that is usually selected or constructed. These “affective intensities” propel the entire research assemblage in a co-creation of “data” in the field, to the “data” analysis and beyond. Iverson and Renold (2016) map posthuman possibilities in a “diffractive analysis” of female entanglements with a camera. The camera is seen as a posthuman player in the filmmaking assemblage and becomes a configuration of girls-with-camera. The emerging girl-body-camera-landscape in the study is co-produced as an intra-acting assemblage, a ‘cut’ that affects the gaze in specific ways. They argue that the role of movement, the way they worked as a group of researcher, the anonymous eye of the camera, everything affects the film-making. These studies are all examples of *how* an anthropocentric ontology, as an inevitable part of qualitative methodologies can be challenged also when it comes to data production. As pointed to earlier the importance of doing so, is frequently highlighted by many (Lather & St. Pierre, 2013; MacLure, 2013; St. Pierre & Jackson, 2014; St.Pierre, 2011).

Nevertheless, the observation of the discrepancy between how posthuman theory influences thinking around and theorizing empirical phenomena and how these phenomena actually turn into data inspired us to explore if it could be possible to employ data production differently by plugging methods of data production into theory. We argue in line with scholars such as Lather (2013), MacLure (2013), St.Pierre (2011) and Taylor (2016), among others, that we need to exercise “vigilance to the unwitting ways that humanist remnants smuggle themselves into posthuman research intraventions” (Taylor, 2016, p. 18). This is not only of theoretical interest. Producing data differently in educational science disrupts taken-for-granted assumptions and positions in education and make possible for hitherto silenced or subsumed agents to become visible. Thus, the experiment emerges from a shared interest in exploring how posthuman theory can be used in relation to data production in education. So, this paper explores (ways of performing) a classroom study where posthuman theory and data production are plugged in to each other from the very outset of this effort. This means that we have to challenge conventional qualitative methodologies, where the human is granted a privileged position, and produce data differently. This is studied in an upper secondary school, in one Physics classroom. As the interest primarily focus the classroom practice in relation to data production, the choice of subject (Maths, English, Physics...) was considered less important. The way we work with theory is by plugging in (Deleuze, 1997, pp. 7-9) (to) post human theories, by picking useful theoretical concepts in relation to their operational potential in the research production (Jackson & Mazzei, 2012). We ask ourselves if it is possible to construct a research machine that can produce data in educational studies without an exclusive focus on human agency and action. Such a machine is here seen as assembled by occurring entities in the exploration. That is a machine that interacts with a multiplicity of entities produced by posthuman research as equally important. The concept of a research machine is central and is inspired by Deleuze and Guattari's (1987 p. 28) thinking on “abstract machines”. We consider the machine as simultaneously and interdependently produced with the research itself. The research machine enables the onto-epistemologies that do not separate ‘knowing’ and ‘being’ but describe the world as interactions, or entanglements, instead of subject and object, human and non-human (Barad, 2007). The interest is not to do research aimed at finding or asserting the meaning of studied phenomena, but to scrutinize how and with what effects the phenomena are made to matter. We try to keep the theoretical and empirical vision of the posthuman as trying to resist clarity or certainty, asking questions rather than providing answers.

In sum, the article describes a posthuman methodological inquiry where a group of educational researchers explore the possibilities of performing research in education, with a focus on a posthuman theory and data production. This experimental research practice may open up ways to think the unforeseen, the temporary, unpredictable and contingent in educational spaces (Taylor, 2016, p. 21).

A Research Machine

As explained, the argument for working as a research machine emerges from the problem with the common anthropocentric gaze in educational research. As pointed to, being a conventionally human-centered field, educational research provides specific challenges to this. The challenges are connected to problems of perceptual semiotics as elaborated on by Deleuze and Guattari (1987). The problems are the difficulties of seeing things in ways that are not from a fixed/fixing position but to become with the intermingling multiplicities and constant movement that constitute classroom practices. The ‘becoming with’ is additionally a means of avoiding a tripartite division between a field of reality and a field of representation as well as a field of subjectivity. The desire to work as a research machine is a response to that. It is a way to break loose from customary methodological habits, an intention to “never send down roots, or plant them, however difficult it may be to avoid reverting to the old procedures” (Deleuze & Guattari, p.25).

Consequently, a research machine is composed in this experiment drawing on Deleuze and Guattari's (1987) political philosophy and their notion of *abstract machine*. Such a machine tries to challenge hierarchical power relations and conventional thinking that sustains them. An abstract machine operates within concrete assemblages, which Deleuze and Guattari explain as tetravalent, meaning they have four valences: bodies and expression at the horizontal axis, and territoriality and deterritorialization at the vertical axis. An abstract machine pertains to an assemblage in its entirety: it is defined as the diagram of that assemblage (Deleuze & Guattari, 1987, p. 91).

Thus, just as the abstract machine, the horizontal axis of the research machine, constituted by bodies and expressions, open up for observing non-human entities at the same level as humans and to observe multiparty connections within assemblages (machinic- and collective assemblages). Furthermore, the vertical axis with its territorial and deterritorialized dimensions, help the escape from methodological fixation and instead promote becoming with continuously changing positions throughout the entire research process (Deleuze & Guattari, 1987, p. 91).

So, rather than looking down on single subjects and objects, human and non-human from above or up at them from below, or from left to right or right to left (Deleuze & Guattari, 1987, p.23) the research machine works with intermingling multiplicities and constant movement. This means that all parts of the experiment - the researchers, the studied classroom, the students, the field notes, the teacher, the analyses, the whiteboards, the hands, the mobile phones, etcetera – are connected and thereby constitute the research machine that in itself is a constant process of transformation.

The Research Machine Plugging in

Within the dimensions of the assemblage Deleuze and Guattari's abstract machine, is explicated as effectuated in forms and substances, in varying states of freedom. But to be effectuated the abstract machine must first have composed itself. Furthermore, Deleuze and Guattari explain that such abstract machines have to be dated and named (the Einstein abstract machine, the Webern abstract machine, the Bach abstract machine, etcetera) in order to refer to the singularities of the machines, and to what they effectuate (Deleuze & Guattari, 1987 p. 511). So the machine, composed in this inquiry, is dated and named as the Research machine in order to be singular, and creative, here and now. Also, the named Research machine is plugging in (to) posthuman theory that effectuates the machine in form and substances. This means that the machine is programmed to be put to work with posthuman theory. As a result, it is able to pick up useful theoretical concepts in relation to their operational potential in the production of "data." Accordingly, in its becoming as a research machine, in its functioning, it is productive of concepts, of borrowing concepts, of inventing new concepts and approaches, as well as to create new assemblages that may demonstrate co-creation of "data" in the field and beyond.

Plugging with configurations

An initial choice emerged within the research machine that stems from the desire to be able to observe a classroom practice without an exclusive focus on human agency and action. It was debated how to observe and how to formulate notes based on possible connections between different entities. What concept could be helpful in this process? What concept could support in directing the gazes toward multiparty interactions, what could help in zooming in 'the junctions in between' rather than the entities themselves? The discussion went on within the research machine, what to do with different types of possible connections between physical and sensory phenomena, which were to be expected, such as light, sound, and temperature etcetera? As a response, the research machine plugged in (to) the concept configurations, as the aspiration was to enable the research machine to focus on dynamic relations between all entities in the classroom. The concept can be described with reference to Suchman (2007) who uses configurations 'to ask how entities come to figure together and take part in particular situations through mutual adjustment and by tuning in to each other' (2007). The notion of configuration also comes close to Haraway's (1991) writings on cyborgs. She

explains these as hybrids of machine and organism, creatures of social reality as well as creatures of fiction. Thus, configurations are different heterogenic entities contingently connected to one another acting together as a whole. Agency cannot be assigned either to persons or to things but to identify the materialization of the relations between subjects, objects as of ongoing socio-material practices (Suchman, 2007). Sørensen (2011) discusses the usefulness of this concept in her study of material webs in a classroom. She stresses the need for studying socio-material configurations as a means of staying with the question of what is going on rather than attending to questions of meaning and production (Sørensen, 2011 p. 123). Furthermore, Sørensen, (2011) argues that configurations may help in order to observe multiparty connections within assemblages that produce and reshuffle all kinds of entities in messy practices of educational settings.

By putting this concept to work with the research machine it could help in exploring 'how' actions are produced – to understand what is going on. Accordingly, the composed research machine tries to make configurations visible for instance between hands, pencils, light, eyes, screens etc. Entities like these, can be/are connected by relations between them, but also disconnected. By looking for configurations, the idea is to background the agency of teacher and pupils as autonomous human beings in order to support the desire to view the non-human entities at the same level as humans in the classroom. But what about the persons looking? How do we take seriously the posthuman insistence of the researcher as entangled with and co-constituted by whatever she/he researches? We were curious of what would happen if we tried to decenter the researcher subject(s) by using several researchers observing by moving in different spaces of the room. The choice of working as a research collective, is not a claim to an objective standpoint or an attempt to cover as much as possible of what was going on. On the contrary, the research collective is a means of decentering the subject and producing multiple, subjective viewpoints. More than one researcher is tentatively productive of more than multiple socio-material relations. What is more, and as will be shown below, we mapped the affects that emerged between noted configurations and the researchers, and used the notes as products of a common observation, not as individual. Thus, the research collective in the classroom, is aimed at producing the classroom as a messy, entangled multi-relational space. This is done through working with configurations.

The Research Machine Working

With the intention to put the concept of configurations to work with the classroom space, the research machine asked permission to visit the upper secondary school in order to collectively study a lesson. The choice of lesson was made by the school and the research machine was invited to plug in (to) a lesson in Physics. Both the teacher and the 28 students were in advance informed about the purpose of the study, the voluntary option to take part, and were guaranteed confidentiality in reports of results. The particularities of the specific school subject, in this case physics, would of course influence both observations and analysis and might not have occurred in just any setting, but as the focus was on configurations and therefore distinct from many educational classroom studies that focus on meaning making or "truths" of what is going on in classrooms the school subject became minor.

At the same time the research machine received permission to, and so entered the classroom, it was extended. The classroom, which also contained chair-students around three large tables and a whiteboard-teacher facing the tables, and everything else in the room became a part of the research machine. The lesson was about electricity and lasted 40 minutes. During the lesson, the researchers collectively assembled with students, books, tables, the teacher, computers and etcetera into a productively working research machine. Thereby, the research machine's different researchers conveyed visual, aural and other sensory information and each researcher turned these into hand-written field notes. In so doing, the written notations were based on individual observations. As such, it is possible to also consider the research machine establishing five different versions of the room. Another way of understanding this is to consider the research machine as establishing five obligatory

passage points (Callon, 1986) to what could possibly be observed and noted. The becoming of the classroom through the research machine inevitably has to pass through either of these passage points. By making use of the different passage points, instead of the more common single point-of-view, the machine opened up for a complex and diversified rendition of becoming and effects of configurations in the classroom. This is not to be understood as a means of producing more objective data independent of the observer. Rather it is a way to open up for exploration of what happens with intermingling multiplicities and constant movement in the classroom – the constant process of transformation of the entire research machine. With this background, each researcher - or passage point - produced field notes as their versions of the classroom, resulting in five different observation sheets.

The Research Machine Producing

In the sections above it has been carefully explained how a research machine sensitive to configurations between different elements in a classroom can be put to work. In this section, the research machine moves forward and tries to explore what is made observable through this machine? This is done by further accounts of the research machine - the constant process of transformation of the research machine – when producing research. As the research machine relates to the diagram of the assemblage this is not a matter of language, as Deleuze (1987) teaches us, except for lack of sufficient abstraction. It is instead an account of how variables of heterogeneous bodies and expressions are distributed, emerge, join together and in dimensions of territoriality and deterritorialization (Deleuze & Guattari, 1987) continuously change positions throughout the entire research process/assemblage. That is to say, talking with Deleuze & Guattari (1987), a temporary ordering of those bodies within the assemblage, an emergent unity joining together the heterogeneous bodies in a “consistency.”

Observations turning into field notes

By looking for, and making notes on configurations, the research machine’s documentation of the observations differs from field notes where the interest is to tell stories about human participant activity. Instead, in this case it was the bodies and expressions that the researchers (within the machine) attended to as connecting, the configurations, which were turned into field notes. In other words it was different heterogenic entities contingently connected to one another acting together as a whole, not the human beings alone, in the classroom that were produced through the observation. The research machine hereby agreed with Jones et al. (2010) and MacLure’s (2011) suggestion: to use a ‘baroque method’, which tries to take account of complexity, instead of working for closure. MacLure states: ‘one of the main tasks of post-foundational research must be to interrupt clarity-and closure-seeking tendencies’ (MacLure, 2011, p. 730). She argues that this is important in order to resist intolerance of complexity, vagueness or ambiguity. The baroqueness of the field notes were reflected both in the process of writing them and in the products, i.e. the actual notes on the sheets.

Parts of the research machine were overwhelmed by the limits of language in relation to find ways to give voice/create language to silent/non-speaking entities when transforming the observations into notes of configurations. This process therefore resulted in what could be described as fragments of the actions in the classroom. All the field notes, independent of researcher, had the character of snap shots of what emerged as specific local configurations, rather than accounts of the lesson as a whole. As there were no conventional (human) subject central to the observations, which usually helps to narrow the observations in allowing a focus of specific subjects’ actions or e.g. following their use of artefacts, what was documented emerged from relations between the researchers and the materialities, bodies, and activities in the classroom (challenging for the researchers to cope with sorting out what was going to be documented). Compared to more traditional observations, the vision was in this case split, or divided, in trying to observe/produce intermingling multiplicities and constant movements in spaces of the classroom. Therefore, the field notes turned out, on occasion, to have a tendency to become both textual and visual (Figure 1). As there were more than a few

configurations appearing and changing rapidly at the same time it helped to make sketches or visuals instead of only producing text to speed up the notation of the simultaneousness. The visuals also helped to envision the fluidity of specific connections, movements and processes in relation to the bodies, expressions and configurations.

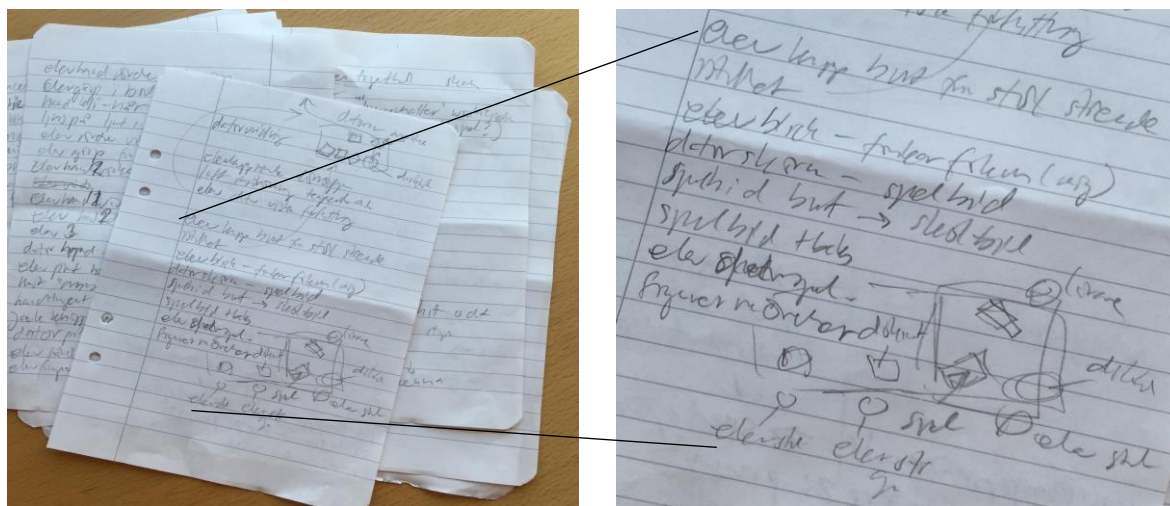


Figure 1, the field notes became fragmentary with unconventional writing techniques and had a tendency to become both textual and visual.

So, it was a challenge for the research machine's researchers to document and become with the continuously changing positions throughout the observation. The field notes also turned out to vary in relation to the different researchers, sometimes they became disconnected or even insipid in trying to document the classroom with its continuously changing dimensions of territoriality and deterritorialization (Deleuze & Guattari, 1987). At times, the field notes became like poetry leaving a vagueness in their expression as there were seldom complete sentences found within them. The two following translated examples show how the field notes emerged differentiating, fragmentary, vague, unconventional, and with unintentionally artsy or poetic character.

Example of field notes of ER

- Ammeter-hand for two-three different body-chairs. This leads to speech from bodies.
- Penn-board-hand => writing
- Pulpit-computer-hand => computer turns on
- Board-projector-computer => image (which steer bodychairs-table's notions)
- Hand-compute => projector light => moving pictures
- Table-body => half-lying body
- Computer pulpet-hand => turn off the light from computer
- Configurations with backpacks, electric cords, earphones, computers and mobiles
- Paper-hand pen => writing
- Phone-hand => writing

Example of field notes of AMB

Handmagnet becomes table magnet, trembling
 Handpaper blur writings on the board, space creating
 Handelectric switch buttonclick, hallgloom
 Voice "cosy"
 Teacherbody complete boardactivity, reconfiguration
 Contacthandelectricalpowercordfinickyact
 Cordfinger movement
 Bagcomputerchordtapsink

When working with the field notes as they emerged a difference appeared in relation to production of more conventionally written notes. It became on the one hand more difficult to grasp the "substance" of them. How to work with a fragment like "ammeter-hand for two-three different body-chairs. This leads to speech from bodies."? On the other hand, these kinds of notes helped to produce a multitude of processes and positions in the classroom that otherwise tend to remain unattended or "shadowed" by more molar stories. As discussed by Jones et al. (2010), the fragmentary uncertainty of inconsistent and insubstantial classroom field notes may confront seeing with thinking, and thus make it possible for research to 'become with' actions or configurations that are not immediately obvious.

Field notes turning into workshops

As a next step the research machine transformed radically as it left the classroom with all its entities and configurations. At the same time, it was deterritorialized by some of these bodies and expressions as they were added to the research machine in a different form. They had turned into the field notes and as such they were added as a new part of the research machine. The sheets of individual handwritten field notes that for a moment contained (territorialized) configurations, were possible to bring to a room at the university. The field notes were subsequently processed into five different digital documents, and the bodies and the expressions were deterritorialized again.

List on the white-board, white-board-light draws attention, eyes towards the board, heads and bodies turn against the board, chair-positions change, backs of chairs rotate towards the board. Talk ongoing, door opening, closing room, another body travels through the room, jackets chafe against jackets, the sound rustles in otherwise muffled silence [...] (Transformed and translated example from field notes of KEP)

Emerging now as five digital notes they were put together and analysed as a whole. The research machine was hereby also reconfigured, to collectively discuss and further process the field notes. This phase consisted of a number of workshops where the scrutiny and intermingling of the digital notes gradually grew. The research machine was experimenting with different concepts and their potential for thinking with data and theory (Jackson and Massei 2012). The digital field notes were explored in detail guided by the question - what is made observable with the present research machine? The entire process was steered through discussions and ensuing notes and images on a white board. Everything of interest was written on that white board, which thereby became a central entity of the research machine (Figure 2). These notes were written as single words and the field notes were again reshuffled and deterritorialized. They emerged also as associating words or expressions. Some of the words pointed to bodies, some to actions, and others to expressions as theoretical concepts.

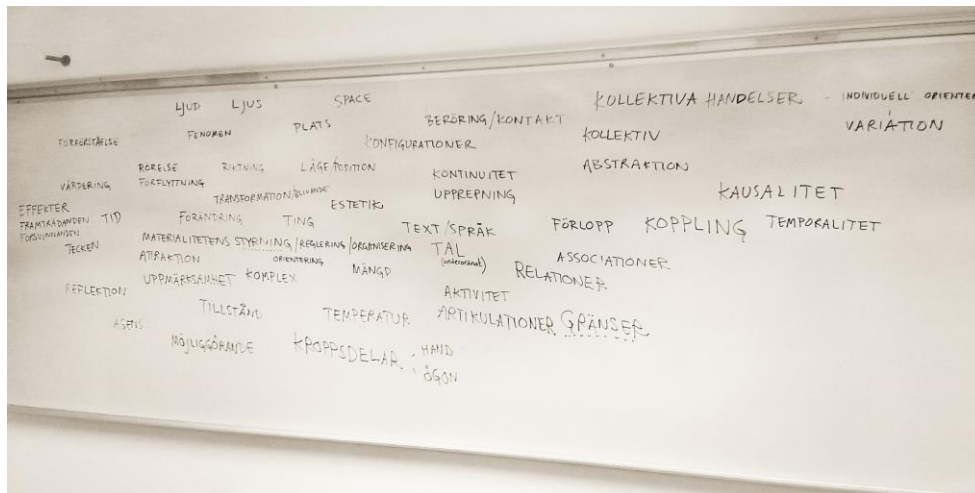


Figure 2, the field notes written as single words and as associating words or expressions at the whiteboard.

Subsequently, the research machine mapped the words at the whiteboard in different clusters (Figure 3). In this way, it was explored what specific configurations that had been observed and had emerged in and from the field notes. The question that was penetrated at the same time was, how these were or rather became observable in the classroom? Through this experimentation the research machine found it necessary to plug in (to) concepts that could support in order to describe how the configurations were emerging.

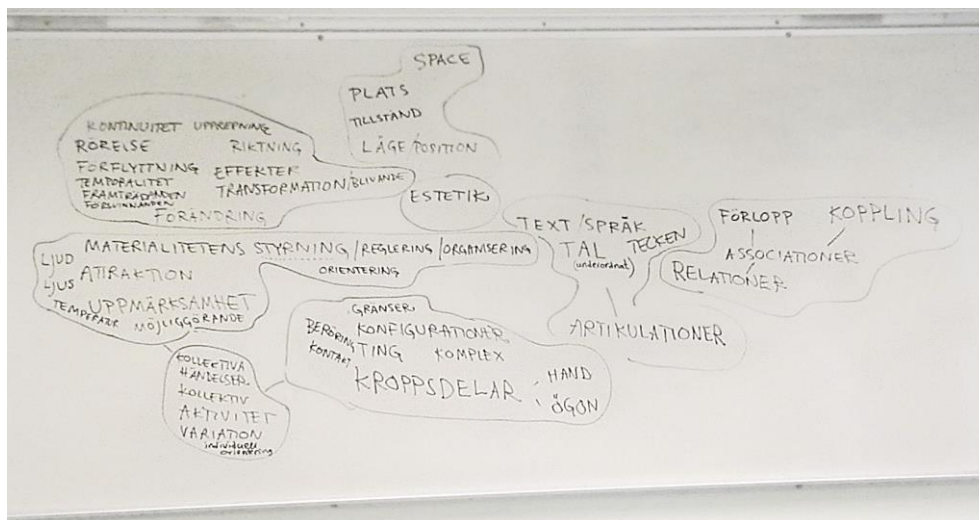


Figure 3, the research machine mapped the words at the whiteboard in different clusters.

Workshops turning into concepts

The research machine turned (for a while) in to a machinic assemblage filled with theoretical discussions and texts that were plugging in. That made it both stable and unstable. It had definite closure-seeking tendencies at times and had also to interrupt itself to escape fixation, seeking instead to become with the continuously changing positions that the machine was put in, as it tried to understand the observations. The concepts that the research machine was gradually plugging in (to) appeared in the discussions as they seemed to have potential in order to support the descriptions of how the configurations were emerging. Some concepts appeared in the discussion but faded away as they failed to fit into productive entrances of the machine. Other concepts seemed to function together with the machine in a way that made them form consistent/persistent parts of it. Due to their productive connections with the working concept of configuration, *attraction*, *affect* and *articulation* emerged as such concepts in the research machines discussions. They were

repeatedly plugging in as tentative but more stable (even if not closing) concepts of the machine. At first they were discussed with references to different scholars as, Barad (2003, 2007), Deleuze (1994), and Latour (2004). The concepts emerged as entangled and overlapping, but not identical to each other. Describing the exclusiveness of each of these concepts was necessary for the analysis to move on (Figure 4).

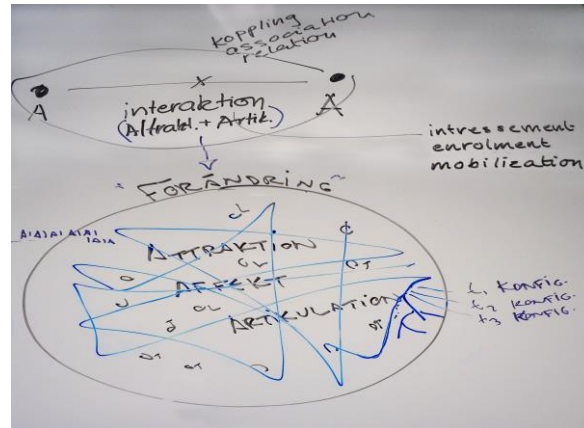


Figure 4, an image from a workshop of how the configurations became observable in relation to the concepts articulation, affect and attraction. The blue lines shows 'chains' of configuration in constant change (in Swedish förändring) plugging in to the concepts.

However, recognizing this does not mean that it would be possible to make any separation of these concepts from each other in the machine at work (Figure 5).

The writing procedure demands picking one of these concepts out as a first one. However, any of them could be the first one since they are overlapping in both space and time. Thus, as a point of departure, one could say that every piece of space and time (assemblage) in the classroom is filled with a plethora of articulations. An articulation is not a property of human speech, it overarches the division between subject and object (Deleuze and Guattari 1987). Articulations should here be understood as relational movements of bodies and expressions in the classroom (Latour, 2004). However, not all of the articulations come to matter with the research machine. To describe how an articulation becomes observed (observable?) the concepts of affect and attraction are needed. Affect is understood as the response prompted by an experience (Deleuze 1997). Affect is the capacity to move, the power or the force of articulations (Barad, 2003). Attraction is also a power, but it is a power that pulls objects towards one another. What distinguishes attraction from affect is its connectivity and relation to another object (for instance, an observer). Whereas affect is independent of any observer or other object, attraction is defined by reciprocity.

In the classroom, configurations were affective, producing responses such as of movement, speech, silence etc. Some of the responses became stabilized as they formed part of the note pads of the observers. To become a part of the notes, an articulation had to come to matter in the machine. Attraction, as the movement of one object towards another, is used to describe this process, when an entity, object, phenomenon or configuration is made observed/ observable and thus affective in the research machine.

Projector-computer-light-board and hand-pen-board together with body-floor-board get effects through what emerges on the board which in turn makes possible speech from pen-body. Body-chairs at tables turns towards board and pencil-computer-body (Translated field note from KEP)

The configurations "projector-computer-light-board" and "hand-pen-board", make articulations that appear on the board. This creates affect that become visible in expressions of attraction as student-

glances and body-chairs turn towards the board. So, when articulations appear on the whiteboard in the classroom, they show to be affective and producing attraction between the board and student-glances and body-chairs, producing changing positions. Thus new configurations are created like student-body-boards and pen-hands-papers as well as key-fingers etcetera.

To explain further, the white board-light configuration is shown to articulate towards bodies in the classroom i.e. eyes, heads and faces and to chairs in the room, as the articulations are affective, consequently creating attraction, new configurations emerge. This *change* is identified as the new configuration of white board and light, the same way that the door, identified later, is made relevant as opening and closing, which is a change in state from it otherwise remaining closed (or open). This makes new configurations stand out, i.e. leads to constantly changed positions in the classroom. New configurations emerge as white board-eyes and teacher-pen-white board or door-close-room.

So what this research machine made observable was how configurations emerge as they become visible through changes in the crossings, or connections, between entities. In other words, the change happens through different connections between bodies and expressions in the classroom. This is a reciprocal process, as the “eyes” of the research machine seems to be attracted by change, and the machine, in turn, creates different configurations within this change (configurations that make up the production of data). As such, the research machine is part of making certain configurations visible, even though the bodies, and their interactions, are present in the room nonetheless. These configurations are unstable. Thus, the observations or rather the field notes appear as one way of pausing or stabilizing an unstable configuration. Some things go through the research machine, while other things pass the machine by, unnoticed, and thus the machine could be said to be the obligatory passage-point(s) (Callon, 1986) for what is then produced as field notes.

Concepts turning into questions – a new concept or process?

By the account above the productive observations of configurations in the classrooms are neatly elucidated as changes of the bodies and expressions. As previously explained, these are produced by connections that emerge due to articulations, affect and attraction. But to be true, the research machine found it difficult to make clear distinctions in this process of changes, and it was hard to make distinctions between the articulations, the attraction and the affect. During the discussions within the research machine, it developed a desire to work with a concept that could pick up on notions related to articulation, affect as well as attraction. A concept was needed that made it possible for the machine to describe what is made observable and how it becomes observable when working with observations of material-semiotic processes in the classroom.

The three concepts articulations, attraction and affect are all parts of such a process, but the process cannot be distinctly separated as in segments by the three notions. Hence, the research machine asks what would such a concept be and become, a notion that stands for such engagement and such process? Is it possible to create a combination of the three concepts? And if so, how can such a concept be defined and explained? How will such a concept “work” and plug in (to) theory? Without these answers the research machine moved to engage in creating something that would help to extend a thinking at the limit of the ability to know as made possible by existing theories. The research machine sought rather a process than a concept, something that could both make visible *and* be put to work. This is in line with Braidotti (2002) who urges “the challenge lies in thinking about processes, rather than concepts” (p. 1). She explains that it is far simpler to think about the concept A or B, or of B as non-A rather than the process of what goes on in between A and B. Theoretical reason is concept-bound and it is hard to find representations for processes, but we agree with Irigaray (1993) who says that we should work against the fixity and inertia of traditional conceptual thinking. The research machine therefore tried, in line with Jackson and Mazzei’s (2012) words to work with ‘unstable subjects and concepts on-the-move that would intervene in a process...’ (p. 264). Thus, it is the process of making and unmaking connections in a machinic assemblage that sought to be conceptualized and understandable but it was also to get a grip of

what territory that would be claimed by such connections between bodies and/or expressions (Deleuze & Guattari, 1987).

Therefore, the machine developed a concept/process that allows descriptions of changes as configurations. A concept was produced that points to the research machine's possibilities to attend to these changes. As a limited effort to map how this attention emerges the research machine suggests the concept of *affraction*. Affraction materializes from the aforementioned three concepts *affect*, *attraction* and *articulation*. The research machine argues that affraction is a concept/process that allows mappings of how changes of configurations come about and are made observable, where affect, attraction and articulation are different aspects rather than distinguishable processes. Affraction is a means to map how attention emerges with entities when configurations gather, connect, disconnect and change with others in always continuing and changing chains. The concept affraction could therefore be understood as a "cluster-concept". Affraction should not be tied up with the concept diffraction, which is often used in different forms of analyses as a way of coping with epistemological problems of representation (Barad, 2007; Haraway, 1997). Affraction instead, can be seen as a way to view the gaze or rather map attention in an observation situation. Tentatively, affraction is mapping the gathering and assembling that makes material-semiotic processes observable in coming into being. We claim that this is a kind of understanding that may help to detach investigations from human concerns and positionality.

So, the concept and process of affraction may help in creating a line of continuity between different privileging perspectives. The concept affraction is not yet fully developed. The notion has to be further refined and worked out in more detail in order to be a means of putting method to work with theory in classroom studies and thus to produce socio-material accounts of classroom spaces.

The Research Machine Discussing

The interest of this article was to investigate the possibilities of producing posthuman data production in educational studies. The attempt was to produce an inquiry where all parts, data production as well as analysis, was plugged in (to) posthuman theory. Hence, a research machine was constructed that is able to produce data without exclusive focus on human agency in classroom studies. All parts of the inquiry – the researchers, the students, the field notes, the teacher, the analysis, the whiteboards, the hands, the mobile phones, and etcetera were connected, contributing to the machine that itself always is in a constant process of transformation. The main focus in these emerging assemblages has been on methodology, not on the educational practices of the classroom we have studied. The educational import from the methodological experiments are central though. The methodological insights reveal on one hand a research practice that promotes ethical responsibility in ways of openness, carefulness and competence. A process where data, ideas, tools, results are exposed and critically examined in the process of doing (working together as a research machine). Working as a research machine seems to produce possibilities to by-pass or thwart some of the challenges of being a human in doing posthuman research as it promotes possibilities to operationalize the 'unself', it promotes a deconstruction of the human as a bounded non-porous subject. The individual, researcher as well as students and teacher, dissolves and assembles. It is a tangible example of how data, data production and researcher(s) are entangled producing each other (Davies 2014; Lather & St. Pierre, 2013; Ringrose & Renold, 2014). On the other hand, working as a research machine making the individual bodies of the researcher more or less invisible may in turn promote blurriness and an undistinguishable character of bodies. In ways they are visible and at the same time not – who chooses, what words are written? How does the researcher entangle with/in a research machine? To improve clarity here in relation to ethical requests is a challenge and a paradox for professional expertise with a posthuman stance as it is only by keeping the theoretical and empirical vision of the posthuman, the ambition to resist clarity or certainty can be achieved.

However, the research machine does not claim to entirely solve or meet this challenge of being a human in doing this kind of research. Is it even possible to completely get away from the self or to what extent would that be beneficial to the outcomes of research? As soon as a desire to 'overcome a human position' as a researcher is expressed, we realize the problematics entwined with this. Any disentangling, therefore, has to be a continuing and incisive critical practice, not one done easily or 'once and for all' (Taylor, 2016).

Still, a posthuman research machine that is sensitive to configurations makes it possible to study other-than-human and more-than-human interactions or entanglements in educational practices rather than binary/dualistic and simplifying interactions between subject and object, human and non-human (Barad, 2007). This kind of data production helps to work towards what i.e. Jones et al. (2010) and MacLure (2011) have pointed at which is trying to renounce or defy clarity, purity or uncomplicated inclinations of processes going on in a classroom, hereby differing from many educational classroom studies that focus on meaning making. Instead, in line with other posthumanist studies, the research machine affirms the insight that it is impossible to find or assert the true meaning of what's going on in a classroom (or elsewhere). We tentatively assume that the products of this kind of machine are mappings of configurations in change. Could these mappings, for instance in the form of "insubstantial" field notes instead help to nuance and broaden potential "truths" or meanings in classrooms? Furthermore, by seeking to map how and with what effects different configurations in a classroom are made to matter, one might be helped by working with changes in the physical space. Could the notion of change, closely connected to both configurations and affraction, work as a methodological concept that weaves the different parts of the research (the process, the machine!) together? Also, what becomes obvious is the impossible, or rather extreme simplifying enterprise, of separating the researched from the researcher, theory, the participants of the study, curriculum, educational politics, etc. Thus, the machine enables onto-epistemologies that do not separate 'knowing' and 'being' but describes processes of mattering, changes, and affraction.

Of course, every research machine would have its own particularities, its own singularities, since such a machine is named and effectuated in a specific space and time. However, some questions, crucial to the process, emerge. This way of working with posthuman data production exposes how responsiveness is needed to the question of frames and boundaries. Thoughtfulness is needed of the boundary work through which a given entity is delineated as such. Beginning with the premise that discrete units of research are not given but made, we need to ask how any object of inquiry – human or nonhuman or combination of the two – is called out as separate from the more extended assemblage of which it is part. Addressing this questions opens up for a further discussion on the need for "calling out" other entities or combinations of entities (configurations) than those conventionally understood as fundamental of educational practices. This raises also questions on if and how we can work with alternative machineries in ethnographic fieldwork, and construct these machineries as a means of making them more sensitive to unconventional presences (Lorimer, 2015)? A research machine, focusing on other-than-human, more-than-human, and unconventional presences, needs to find ways to come about with debated challenges like for instance how to redirect the gaze in observations. Assembled questions would be how to work in classrooms with all the parallel or shadow stories that can be found going on simultaneously. In what ways are they relevant? Is there any way to benefit from them all? Is there a need for limiting, if even possible, the amount of stories and if so, why? The machine might help in providing a humble conclusion, arriving at the impossibility of humans on top of these things and in control of all these stories. Thus, if this is true, how might this change the way humans become with educational practice and research methodologies?

To conclude, as letting go of the ever-changing research machine in this study, by allowing this paper to plug in (to) other researchers, desks, discussions, texts, etcetera, the last emphasis is to further highlight the challenge of posthuman research practices and the methods of producing data in

relation to posthuman educational research. A research machine may open up possibilities to produce educational research that aids what otherwise might be shadowed actions in classrooms and draw attention from regimes of normalcy and oppressive institutional sedimentations that education spaces otherwise often require us to embody (Taylor & Hughes, 2016). In that way, it offers possibilities to subvert and disrupt privileged positions and perspectives in classroom studies. To further escape from presumptions of human exceptionalism and reproduction of what counts as relevant parts/participants in classroom practices new concepts and new conceptual research practises are required.

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