

# HOW MATTER COMES TO MATTER IN THE DIFFRACTIVE ANALYSIS: SCIENTIFIC PHENOMENA AS CO-CREATORS OF KNOWLEDGE PRODUCTION

*The aim of the study is to highlight how matter/nonhumans (scientific phenomena included) come to matter in the analytical work in a research project on emergent science and gender in preschool. The study combines perspectives from emergent science (Siraj-Blatchford, 2001), new materialism (Barad, 2007; de Freitas and Palmer, 2016), and gender theory (Barad, 2003). The data for this paper comes from a field study in a Swedish preschool, in a group of 25 children (five years old) and three teachers, and consists of a video sequence of the co-acting of a girl, a swing, gravity and kinetic energy (etc.). The analysis is guided by a new materialist perspective, especially Barad's (2007) theory of agential realism as well as diffractive methodology. In a new materialist perspective, knowledge production is seen as material-discursive processes, occurring in intra-activity where both humans and nonhumans are seen as agents (Barad, 2007). To strengthen the focus on the scientific phenomena as agents the thought of: "Scientific concepts as 'material articulations' of the world intra-acting with all other matter and meaning" is brought in from de Freitas and Palmer (2016, p. 1201). Early findings show that when being attentive to how matter/nonhumans work as agents in the knowledge production not only epistemological but also ontological questions came to matter in the data. The squeaking and mowing swing and kinetic energy posed and actualized questions, besides questions of learning science, also questions of becoming, of bodily experiences with scientific phenomena and identity construction. A contemporary challenge in science education research thus becomes to see that when it comes to "the beauty and pleasure of understanding" entanglements, feelings and embodiment are of great importance in contrast to the traditional image of knowledge as constructed from an "outside observer" – especially when it comes to exploring (children's) scientific identity construction.*

*Keywords:* Knowledge Construction, Emotion, Video Analysis

## INTRODUCTION

Diffractive analysis and other post qualitative methods have been explored within educational research for some years. What many of these studies have in common is to explore alternative ways for doing research and the importance of highlighting nonhumans/materiality as agents in knowledge construction (see for example Hultman & Lenz Taguchi, 2010; Martin & Kamberelis, 2013; Taylor, 2017). This paper aims to contribute further knowledge to the field of science education regarding the application of diffractive analysis. As such, this study engages in how to really be attentive to how matter/nonhumans (scientific phenomena included) come to matter within knowledge production. The (visual) data explored within the paper was constructed (see Barad, 2007 on the thought of constructing data) during a field study in a Swedish preschool. The overall aim of the study was to create knowledge on emergent science (Siraj-Blatchford, 2001) and gendering with focus on the children's co-acting's with the preschool environment. This paper is guided by the two research questions:

- In what ways are the scientific phenomena (kinetic energy, gravity, force etc.) and other nonhuman agents in the data co-creating the knowledge construction?
- What knowledge specifically comes to matter/comes to the fore as the nonhuman agencies in the data are closely engaged with?

## Knowledge construction as material-discursive processes

To “make space” for the nonhumans (Taylor, 2017) in the data, a new materialist perspective is being used in this paper; foremost Karen Barad’s (2007) theory of agential realism. In a new materialist perspective, knowledge production is not only connected to humans or human meaning-making, but is instead seen as *material-discursive processes*, occurring in *intra-activity* between humans and nonhumans (Barad, 2007). Barad(2003, p.829) explains that “practices of knowing cannot be fully claimed as human practices, not simply because we use nonhuman elements in our practices but because knowing is a matter of part of the world making itself intelligible to another part”. As such, Barad (2003) speaks of material-discursive practices or forms of agency. Furthermore, knowing is seen as always mutual and simultaneous with processes of becoming (Barad, 2003, 2007). In this sense, knowledge production becomes an ontological question as much as an epistemological. Thus, the researchers’ thinking and agency can be thought of as embodied *material enactments* (Barad, 2007). To strengthen the focus on the scientific phenomena in the data the thought of: “Scientific concepts as ‘material articulations’ of the world intra-acting with all other matter and meaning” is brought in from de Freitas and Palmer (2016, p.1201).

## METHOD

The chosen data for this paper is a (4,5 minutes long) video sequence, constructed during a field study in a preschool outside a bigger city in Sweden, in a group of 25 children (five years old) and three teachers. During the field study, participant observations, including video recordings and field notes, were made over a period of 5 months. In total the observations amounted to 155 hours, out of which 12 hours were video-recorded. The study adheres to the Swedish Research Council’s principles for research ethics (Swedish Research Council 2011) and has been approved by the regional board for research ethics. The chosen video clip for this study includes the co-acting of a girl, a swing, gravity, kinetic energy and other forces (etc.). The same video clip is used in another ongoing study (Author, 2019) with focus on children’s learning and becomings together with scientific phenomena and was chosen for this paper to generate further methodological contributions. In the analysis, Barad’s diffractive methodology and diffractive readings (Barad, 2007) were used. Diffractive analyses are about looking for differences within phenomena, focusing on encounters, co-actings and entanglements, and what these differences might do. Diffractive readings imply reading different insights (concepts, materials, parts of data and so on) through one another (Barad, 2003). During the readings it has been explored how the movements, sounds, bodies, matter, scientific phenomena and so on in the data can work as agents in the knowledge production together with the researcher and the theoretical concepts.

## RESULTS

The preliminary analysis show examples of how the agents in the data made the knowledge production a material enactment (Barad, 2007) or an embodied and entangled process. For example, when closely focusing on/together with the movements of the swing in the video sequence, a swinging feeling was created also in my body (mind). That is, the forces, kinetic energy and moving swing affected my brain and experience of my body in the room. In this sense, I got to know/feel the “swinging” as a material articulation (de Freitas & Palmer, 2016) in my body. Also the squeaking sound from the moving swing worked as an agent which co-created the feeling of swinging in my body in terms of “awakening” materialized experiences of feeling free and light when swinging as a child. When being attentive to how the matter/nonhumans worked as agents in the knowledge production not only epistemological but also ontological questions came to matter in the data. The squeaking and moving swing and kinetic energy posed

and actualized questions, besides questions of learning science, also questions of becoming, of bodily experiences and identity construction. This made questions come to matter about the girl in the data and how her identity got constructed in close relations with the swing, kinetic energy and other forces. For example how she, together with these, could jump higher and longer than from the ground and become as someone “brave” and “strong”.

## DISCUSSION AND CONCLUSIONS

One preliminary conclusion of the study is that when the researcher “really” tunes in with the nonhuman agents in the data, aspects which sometimes are excluded from knowledge production can become important agents, such as materialized experiences of swinging. In other words, a knowledge production including entanglements, affect and embodiment (Hultman & Lenz Taguchi, 2010), in contrast to the traditional image of knowledge as constructed from an “outside observer” (see further in Martin & Kamberelis, 2013). In line with how Taylor (2017, p 319) describes it, a knowledge production which is “pluralized and distributed rather than being a matter of individual minds or bodies”. Becoming researcher in this entangled way enabled embodied entanglements with the scientific phenomena in the data for the researcher, which also led to the highlighting of the girl in the data and her identity construction together with the kinetic energy and other forces. As such, new materialism creates affordances of how scientific phenomena can create affordances (or constraints) for an individual’s becomings as scientific, in contrast to how “science identities” research typically considers how individuals relate to broader socio-cultural characteristics of science as a community. However, there are no fixed or predetermined ways of how to become “an entangled researcher”, or how to make nonhumans matter in the knowledge production, rather, as Taylor (2017, p. 322) puts it, this “requires making methodology anew with each research endeavor”.

## REFERENCES

- Author. (2019)
- Barad, K. (2003). Posthumanist Performativity: Toward an Understanding of How Matter Comes to Matter. *Signs*, 28(3), 801-831.
- Barad, K. (2007). *Meeting the universe halfway. Quantum physics of the entanglement of matter and meaning*. London: Duke Universal Press.
- de Freitas, E., & Palmer, A. (2016). How scientific concepts come to matter in early childhood curriculum: rethinking the concept of force. *Cultural Studies of Science Education*, 11(4), 1201–1222. doi:10.1007/s11422-014-9652-6
- Hultman, K., & Lenz Taguchi, H. (2010). Challenging anthropocentric analysis of visual data: a relational materialist methodological approach to educational research. *International Journal of Qualitative Studies in Education*, 23(5), 525-542. doi:10.1080/09518398.2010.500628
- Martin, A. D., & Kamberelis, G. (2013). Mapping not tracing: qualitative educational research with political teeth. *International Journal of Qualitative Studies in Education*, 26(6), 668-679. doi:10.1080/09518398.2013.788756
- Siraj-Blatchford, J. (2001). *Emergent science and technology in the early years*. Paper presented at the XXIII World Congress of OMEP. Retrieved from [www.327matters.org/Docs/omepabs.pdf](http://www.327matters.org/Docs/omepabs.pdf), Santiago, Chile.
- Swedish Research Council. 2011. *Good research practise* [God forskningsed.] [www.vr.se](http://www.vr.se)
- Taylor, C. (2017). Rethinking the empirical in higher education: post-qualitative inquiry as a less comfortable social science. *International Journal of Research & Method in Education*, 40(3), 311-324. doi:10.1080/1743727X.2016.1256984