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Investigating inseparability, agency and becoming: Intra-acting with the robotic lawn mower[1]

Reflection paper

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Introduction – about sociomateriality

Sociomateriality is understood as a development of studies of sociotechnical systems, practice theory and actor-network theory (Cecez-Kecmanovic 2014). Sociomateriality comes with several highly abstract notions, such as inseparability of agencies, entanglements , or agential cuts (Orlikowski 2007, Barad 1999) to name a few, which are considered hard to understand and use in research (Cecez-Kecmanovic 2014). As these notions usually are considered to be very abstract, in this paper I will suggest a practical illustration that hopefully will lend some clarity through the help of its concreteness that can support increased theoretical clarity and offer a coupling to empiric studies. The mangle operate[s] … at a level of detail not usually accessible to empirical study", says Pickering (1995, p. xi). He gives detailed descriptions of entanglements of human and material agency from the domain of physics, but his example about computer use is more trivial (Pickering 1995). Here I will give a detailed illustration of human – computer entanglements as they play out over some time and reflect on how entanglements and agency can be understood and conceptualized.

Humans are not imposing agency on passive matter. Materials have properties of their own that guide or restrict the movements of the craftsperson. The twig that is used in weaving a basket influences the form of the basket, and how it can be used in the emergent design. The weaver chooses a twig that bend in a fashion that fits with the design that is underway (Ingold 2000, 2011).

Barad (1999) claims that the entanglements of agencies is epistemological, not ontological, in Pickering' account (1995). The entanglement is related to our perceptions and how we make meaning out of our perceptions. The agential cut is our choice as to where we locate the agencies that are involved (Barad 1999). Leonardi (2011) talks about imbrication, and describe them to have degrees of entanglements. The entanglements of agencies produce changes, "though in a non-deterministic way" (Leonardi 2011). Practices produce changes in the material and physical conditions which again induce changes in the practices (Schatzki 2010).

[1] This is very much an early working paper under development. Hopefully, I will present a more developed paper at the seminar in Uppsala.

In this reflection paper, I present a (more or less) ongoing study of intra-actions between human and technological agency illustrated in an empirical case of introducing a robotic lawn mower into a garden. The garden is initially not completely in line with the requirements specification for optimal function of the robotic lawn mower. As the automower is installed into the garden, various transformations are brought about over time by the human garden owners for it to operate with less problems.

The garden that is presented here is my own, and the human gardeners involved are me and my husband. I have taken the photos to illustrate and document the intra-actions and emergent transformations taking place. The study has taken place in the summer seasons from May 2014 to September 2016.

Introducing Roberto the robot

The manufacturer presents the automower as something that will mow our garden while we, the garden owners, are relaxing (Figure 1). I want a garden with lots of variety, with plants, trees and bushes and possibly small surprises around the corners. The advertisements says that the automower will function better in a plain and square garden without many obstacles, and that it cannot handle stairs and inclinations more than 20%. I bought the automower after considerations over several months, including talking with neighbours who own an automower and visiting their gardens to see the automower in action. I was particularly concerned about how the automower managed slopes and obstacles, as parts of our garden are a bit steeper and have more obstacles than the requirements indicated. However, wanting less mowing work made me make up my mind to try the automower.

Figure 1: The advertisement shows that we can relax while mowing (Photo: Husqvarna).

Figure 2: Introducing Roberto, who requires an uncomplicated garden.

Installation

My husband decided that we do the installation ourselves, as it would allow us to become familiar with the robot by gaining practical experience from deciding a suitable layout of the electronic fence, laying out the cables and coupling them. First, Roberto needs a base station and an electronic fence that defines the boundaries of its area of operation. We selected a location for the base station partly under the veranda to give it some protection from the rain (Figure 3). We stretched the electronic fence from the base station, encircling the lawn and fastened it to the soil with plastic plugs resembling tent plugs (Figure 4). We laid out and connected a guiding line leading from the far end of the fence and up to the base station, to help the automower find its way home when it needs charging (Figure 5).

Figure 3: The base station was installed under the veranda.

Figure 4: The electronic fence is laid on the soil.

Figure 5: The electronic fence is connected to the guiding line.

Making the garden less complicated

It did not take much time before we experienced that Roberto had some problems in our garden. He often stopped and produced an error message on his way up the slope towards the base station (Figure 6). We had a tree stump on top of the slope where the slope was less steep, so we decided we had to remove it to help Roberto climb the slope and enter the horizontal part of the garden. I had some plans for setting up decorative flower pots on top of this stump, but we were eager to improve the working conditions for Roberto and got a stump grubber to remove it (Figure 7). A large pile of soil and wood chippings was left after the stump grubber (Figure 8).

Figure 6: Error message 33 “too steep”.

Figure 7: Stump grubber removing the tree stump.

Figure 8: A large pile of soil and wood chippings where the stump had been.

We had to remove this pile using manual tools such as a spade and a wheelbarrow. We wanted to use the wood chippings for firewood, and the mix of soil and chippings for mulching, and took care to store these outside of the electronic fence not to disturb Roberto’s movements (Figure 9 and 10). The soil was prepared for sowing new grass (Figures 11, 12 and 13). While my husband was working with repairing the lawn, he took care to lay out the fence around the grassless spot, so that Roberto could continue mowing as undisturbed as possible. We stored equipment and tools used in the garden during these operations in the sandbox, that was (and still is) protected as an island within the electronic fence (Figure 13).

		
Figure 9: Rests of the tree stump to be used for firewood, stored outside of the electronic fence.	Figure 10: Remnants of the pile left by the stump grubber, stored for later use outside the fence.	Figure 11: Preparing the patch for sowing new grass seeds.
		
Figure 12: Ready for sowing.	Figure 13: The grass seeds are sprouting.	Figure 14: Tools stored outside the fence in the sandbox.

Roberto influences our practices in the garden

During the first months of operation in our first summer with Roberto, we learned that we had to adapt our use of and practices in the garden. Roberto moves about at random, and changes his direction when he encounters the electronic fence or an obstacle (Figure 15). However, some kinds of obstacles can damage Roberto's thin and very sharp knives or be damaged themselves.

		
Figure 15: Patterns in the grass show the random movements.	Figure 16: Roberto may cut the water hose.	Figure 17: A spade left on the lawn can damage Roberto's knives

On the first warm day when the garden needed watering, we found out that it was not a good idea to place a sprinkler on the lawn during the daytime while Roberto was operating. We have little control over where Roberto moves inside the fence. He could cut the hose with his knives, as the hose was not large enough to function as an obstacle (Figure 16). Similarly, Roberto can run over a spade left on the lawn and the spade can come under the knives and damage them (Figure 17). Once Roberto managed to move in parallel with and come on top of the metal foot of the garden trampoline, so that the metal

damaged his knives (Figure 8). We use the trampoline less often now, and when we do, we move it often so that Roberto can access the grass underneath.

		
Figure 18: Apples disturb Roberto's movement.	Figure 19: The tent and its ropes did not go together with Roberto at all.	Figure 20: Ad-hoc protecting Roberto from heavy rain.

In late summer, we learned that apples falling from our apple tree is often damaged by Roberto if they are left on the lawn, and they will often disturb his operation so that he crashes somewhere with a damaged apple in between his knives (Figure 18). I established a new practice of peeking into the garden each morning looking for fallen apples, and removing them before I went to work. The same procedure takes place when I return from work, and if possible, before I go to bed during the apple season. When my daughter was trying out various tents for her summer holiday trip, we had to deactivate Roberto for the whole period of tent testing. We did not trust that he would not cut the tent or its ropes (Figure 19). After some time, we also learned that the veranda does not give enough rain protection for the base station. While we are waiting for my husband to build a small house for Roberto, various work-arounds take place when it rains heavily (Figure 20).

Emergent attitudes

Before Roberto started his transformation of the garden, I wanted a garden with flowerbeds, bushes and lots of variety. Each time Roberto "crashes" and gives an error message, he will stay there until a human resets him by entering his pin-code and starts him again. When I see from inside my house that Roberto needs restarting, this procedure will take me approximately 2 minutes until I am back inside and can continue my activities. In our garden he crashes often, particularly when the lawn is wet from rain or dew. If he crashes when I am at work, nobody will reset him and we will lose several hours of mowing. In wet periods, which there are many of in Norway, he cannot upkeep the normal mowing and the grass grows visibly longer. Our work in the garden focused on enabling enough hours of operation for Roberto, and new attitudes are emerging to attain to this goal.

I have been cultivating a little sapling that will grow to replace the stump that was removed. This little tree has to be protected by the fence and it grows where Roberto often pass when he climbs up the slope in the garden (Figure 22). As I learn that my wish for this sapling to grow larger comes in conflict with my wish that Roberto moves smoothly in the garden, I am less inclined to protect the sapling. However, this is a contested area and the sapling is still there - and growing.

To increase the working area for Roberto, I consider removing some stone steps that hinders Roberto to access a small patch of lawn at a lower level (Figure 21). I no longer find these steps neither practical nor charming, and ponder various ideas for a step-free solution that also Roberto can use for access to the lower patch.

The lawn that is not cut by Roberto is mowed with a manual lawn mower by us. After we have cut the fence line some times when we mow across it, we stopped mowing the area at the steep outer side of fence. This makes traces of Roberto and the equipment that accompany him clearly visible in the garden (Figure 23).

		
Figure 21: The steps do not allow Roberto access to the little lawn patch below.	Figure 22: This sapling comes in conflict with smooth operations for Roberto.	Figure 23: The demarcation of Roberto's area of operation is clearly visible.

Experiences and reflections

We expected that installing Roberto would mean some hours of work for my husband and me. We were prepared for this kind of work. The new practices such as removing fallen apples that we learned was necessary for his smooth running operations turned out to be a lot more work than we expected. The demands that Roberto's operations put on our use practices in the garden was difficult to see in advance. The driving force here is our wish for Roberto to run uninterrupted on dry, nice days for mowing – exactly those days we will like to spend out in the garden.

Sometimes, during these transformations in the garden, I felt like I was working for Roberto, that he was the master and I was the slave. I felt that I spent more time catering for Roberto than for the plants, like in the example with the little sapling. A drive towards efficiency and standardisation was prevailing on behalf of what I previously had appreciated with the garden, such as spending time outside taking care of flowers and berries.

Discussion

The agencies of Roberto and us are entangled in a way where they can only be analytically separated. We do the physical work of transforming the garden, but the work is done solely to improve the working conditions for Roberto. Or perhaps it is the other way around, do we use Roberto to entice or force ourselves to make the garden less unruly and more standardised? And - how will I know what our real and deep motivations are for our activities in the garden?

This circular question has a parallel in the discussion whether metal stirrups was what made feudalism possible (White 1962, Roland 2003). Stirrups appeared in Europe in the eight century, and allowed the knights to stand more upright in a stable position during combat. He could strike with his lance tucked under his arm without risking that he fell off the horse because of an impact. Knights could engage in shock combat as a defence towards the Muslims. White argues that aided by knights, the medieval lords could build strong feudal states (1962). On the other hand, strong feudal lords were the

ones who had the power and riches to develop armies of heavily mounted knights with metal stirrups (Roland 2003). A resolution of this circular argument will be to see them as mutually co-constituted.

Our garden is continuously in its becoming. Some outcomes of these productive entanglements of agencies cannot be disentangled, as the stump that was removed that cannot be put back again. A different tree will need to grow there for several years, and will still not be the same tree. Disentangling the entanglement will not remove the entanglement of Roberto, us, the flower beds, slopes, or the electronic fence, but may create a space for action to ameliorate some if its less wanted consequences (Bratteteig and Verne 2012 a,b). For example, we believe that if we adjust the electronic fence at a place where Roberto often crashes, less crashes will occur. Disentangling may be useful to create a space for change if things grow out of hand, so as to single out agencies that might be evoked for a particular change (Bratteteig and Verne 2012 a,b).

Leonardi's notion of *imbrication* indicates that the various tiles that make up the imbrications are identifiable in a way that they can be manipulated individually (Leonardi 2011). The notion of entanglement indicates a stronger entanglement, where individual elements cannot be traced.

The entangled agencies bring the garden more in line with the specifications for Roberto than it was before he arrived on the scene – a process described as performative (Pickering 1995, MacKenzie 2006). With our help, Roberto has transformed the garden to become more in line with his requirements that were not there at the outset. Different kinds of work are involved in this transformation: first the installation, which to some degree is described by the manual, and then the work to reduce the gap between our garden and Roberto's requirement. How much work this amounts to will depend on the garden, our understanding of these requirements, our ambitions etc. The work involved in the new practices of keeping the garden tidy at all times is difficult to assess. If the gap turns out to seem too large, an alternative would be to throw out Roberto and his electronic fence.

I will end these reflections by suggesting a generalisation of this last point. Performative transformations often happen when computers are put to work somewhere. The requirements for an uncomplicated environment for the digital technologies are rarely fully met, but the entangled agencies of humans and computers will produce an environment more in line with these requirements. Humans will work to reduce the gaps between the environment and the requirements by removing or transforming unruly elements that are too complicated for smooth operations. Knowledge of the boundaries for what´s inside and outside of the area of operation will be important for living with this technology.

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