International Journal of Mass Emergencies and Disasters
March 2016, Vol. 34, No. 2, pp. 231-249

Posthumanist Perspectives and the Chernobyl Disaster: Dances of Agency, Temporal Emergence, and Disaster Risk Management

Owen Abbott
Department of Sociology, Philosophy, and Anthropology
University of Exeter

Email: oja203@exeter.ac.uk

This article applies the philosophical perspective of posthumanism to the Chernobyl nuclear disaster. A posthumanist perspective attempts to break with the notion of human exceptionalism by recognising the performative agency of the non-human. It is maintained that such an approach is necessary to understanding how the disaster occurred in the first place, the calamitous initial responses the disaster, and its long-term consequence – including the environmental restoration that has occurred in the exclusion zone. Indeed, it is argued that much of the previous literature on the disaster takes the perspective of human exceptionalism, which has led to a failure to accurately interpret how the disaster unfolded and how it continues to emerge.

Key Words: Posthumanism, Chernobyl, Emergence, Environmental Restoration

Introduction

On the 26th of April, 1986, the reactor exploded at Unit 4 of the Chernobyl nuclear power station. The consequences were catastrophic. Twenty-eight people who attempted to mitigate the disaster died of acute radiation sickness (Jaworowski 2010), seventy tons of nuclear fuel was ejected into the atmosphere and the surrounding area by the explosion, causing clouds of radiation to spread across Europe (Kortov and Ustyantsev 2013), the suppression of the disaster and the clean-up operation pushed the USSR to the brink of bankruptcy (Gorbachev 2006), and hundreds of thousands of people were evacuated from the surrounding area (Bregadze et al. 2011). But even today, decades later, the disaster continues to unfold in new and unexpected ways. A number of things are exemplified by the disaster at Chernobyl, the responses to it and the subsequent consequences (both immediate and gradual). Firstly, it exemplifies clearly the performative agency of the non-human. Moreover, it shows how human agency interacts with this non-human agency in a continual process that Pickering

(2005) calls the 'dance of agency'. As we will see below, the disaster and the responses to it demonstrate how the human and the non-human were engaged in a performative dance of agency, with each acting and reacting to each other in a continual performative process. Secondly, the disaster and its consequences exemplify the relevance of 'temporal emergence' (Pickering 2008a; Latour 1996). What the disaster became, and what it has become, did not only happen on the 26th of April, 1986. Not only did it continue to unfold through dances of agency during the subsequent weeks and months following the meltdown, but it continues to unfold today, in terms of environmental and cultural effects.

However, it seems that much of the research on the Chernobyl disaster has so far missed these points, which have arisen out of posthumanist perspectives.[1] The reason for looking past these points is the supremacy of the modern dualistic ontology, which has dominated Western thought since Descartes. The dualism has provided the framework for humans to be considered to be separate from machines, animals, and matter, which simply seen to be awaiting the imposition of human intentionality (Rae 2014; Pickering 2013a). As we will see throughout this essay, this has not only led to research failing to get to grips with the disaster, but it was also this modern ontology that facilitated and extended the disaster in the first place. Indeed, illustrating this will be the starting point of this essay. From here, the posthumanist perspectives outlined above will be applied to the chronology of the disaster. Starting from the disaster itself and the immediate responses, the necessity of considering performative dances of agency between the human and the non-human will be expounded. This analysis will continue onto the consequences which continue to emerge. With particular reference to the continued efforts to contain Unit 4, as well as the ecological developments in the 30km exclusion zone around Chernobyl, it will be shown how posthumanist perspectives can inform the continued becoming of the disaster.

Furthermore, the points made throughout this paper will be drawn upon to put forward the argument that posthumanist perspectives provide a clear conceptual framework for understanding disasters retrospectively, and also for planning for mitigating future disasters (Neisser 2014). While this essay aims predominantly to show how posthumanist perspectives should be seen as essential to understanding the Chernobyl disaster, I will also use the Chernobyl disaster to exemplify the importance of posthumanist perspectives as a general challenge to the modern ontology.

The Posthumanist Challenge to the Modern Ontology

In order to see how posthumanism can offer such a challenge, we should begin by offering a more detailed discussion of the modern ontology in relation posthumanist theory. The term "modern ontology" is applied in posthumanist circles to denote the dualistic way of understanding the world which has guided Western thought throughout the modern era (Pickering 2013a; Rae 2014). The premise of the modern ontology dualism is that humans are special; humans are separated from machines, animals and nature because of our capacity for knowledge, reason, morality, culture,

language and passion – to name but a few separating factors. As a result of viewing the world in terms of human specialism, the modern ontology has held that humans have agency, whereas everything else does not. That is, it has been generally understood that it is only humans that can act in the world (Haraway 1992). The assumption that comes with this dualist ontology is that humans can impose their will upon the world, and in doing so, make the world do the bidding of humans (Pickering 2009). This is the process that Pickering (2011) calls 'making the world dual'.

Providing a challenge to this dualistic mode of viewing the world can perhaps be seen as the starting point for the posthumanist school of thought. Indeed, all of the founding members of posthumanism (see: Haraway 1992; Latour 2014; Law and Singleton 2005; Pickering 2009) have offered a number of explanation of why the modern ontology is inaccurate. The first deals directly with the notion that humans and non-humans are ontologically separate. Haraway (1992), for example, points out that human beings are entangled with (rather than separate from) machines and other species, to the extent that our relations with these non-human agents are essential to constituting what we are as human beings. Human beings are not the cause of these relations, but the effect of them (Rae 2014). Bruno Latour, the chief exponent of Actor-Network Theory (ANT), takes this a step further by arguing that we can only understand the ontology of anything in terms of the multidimensional connections between humans and non-humans (Latour 1996). To be able to understand the world around us in this way, ANT insists that we consider anything in the world as an assemblage of human and non-human things, as well as associations, such as theories and conceptual frameworks (Elder-Vass 2015; Latour 2008; Law and Singleton 2005). In these assembles, neither the human nor the non-human can be given precedence because each aspect of the actor-network is of symmetrical importance to the assemblage becoming what it is at a particular moment in time (Latour 2005). Because every aspect is essential to the current form of an assemblage, it makes no sense to prioritise the human over the non-human, or to claim that human agency alone is the cause of a particular outcome (Latour 2008).

This brings us to the second explanation of why the modern ontology is considered to be erroneous by posthumanism. The modern ontology implies that only humans have genuine agency because it is only humans that act with intentionality (Sayes 2014). But, as Latour (2005) points out, acting with intentionality is simply one way of acting which is of consequence to a particular assemblage. He continues that to attribute agency we need only ask: "Does it make a difference in the course of some other agent's action or not?" (Latour 2005; p. 71). Pickering (2005) expands on this by arguing that we, as humans, act in consequential ways in the world. But the world also acts in consequential ways in return. So, in terms of doing things, that is, in terms of performativity, we are no different from everything else in the world. Indeed, the human and the non-human hang together in a constitutive relationship which is continually reacting and emerging in response to the performativity of other entities (Pickering 2013a; Latour 1996). This process continues indefinitely in what Pickering (2005) calls the 'dance of agency'.

Finally, posthumanist perspectives counter the modern ontology notion that we can 'make the world dual'. In relation to the assumption of human specialness, the modern ontology implies that the non-human is under direct dominion of human action. The use of science and technology makes a clear-cut distinction between the human and the non-human by reaching a point at which machines are free-standing. That is, they function with little human interaction. At this point, the world has been made dual in the sense that the non-human no longer really needs the human to make it function - it functions by itself towards the end of fulfilling the will of the human (Pickering 2011). However, as posthumanist perspectives highlight, this process of making dual is never quite complete. We have to continually work with, service and generally adapt to the performative agency of machines in such a way that they are never quite autonomous. Thus, Pickering (2011) suggests that, rather than making the world entirely dual, the best that can be achieved is finding 'islands of stability'. By this he means that we reach a point at which machines function in a semi-autonomous fashion, in which humans still interact with their agency to some extent, while the machine largely enacts the will of the human. It should be stressed that the continued interaction of agency is essential if stability is to be maintained. To give an everyday example, a person's relationship with their car is likely to be akin to an island of stability. Most of the time the car works normally, but to ensure that this continues to be the case we need to top it up with oil and get it serviced regularly. Of course, the unpredictability of such assemblages means that the car may go wrong even if we have maintained the car well. In these cases, a mechanic is required to work with the machine to get it back to working order. In addition to this, Latour (1996) argues that understanding assemblages in terms of ANT also means understanding that stability is the exception, rather than the rule. Assemblages are not permanent and static; instead they are constantly in flow as various agents interact and shape the relations which make up the assemblage (Elder-Vass 2015).

The Modern Ontology and the Chernobyl Disaster

It seems arguable that an island of stability is precisely the point that was achieved just before the Chernobyl disaster. The reactor did what we wanted it to do by producing nuclear energy. The surrounding area also fulfilled the will of the Soviet Union, in the sense that it had been transformed from the ancient marshlands which halted Genghis Khan's progress, into the drained collective farmland which had excellent systems of irrigation and canals (Moller and Mousseau 2011). At this point, it would be arguable that the modern dualism had prevailed. Nature, right down to the atom, had been bent to the will of humans (Harper 2001). But full autonomy had not been achieved; humans were still required to engage with the performativity of the machine and the land. On the day of the disaster, this played itself out in a spectacular fashion.

On that day, scheduled tests on the power supply mode were conducted. The tests were required to assess the functionality of the power supply mode in the event of the

reactor being forced into emergency shutdown. In an attempt to replicate this, staff drastically reduced the reactor capacity. However, the RBMK-1000 reactor could not withstand such a major reduction. Because of this, reactivity increased sharply, causing the explosion (Kortov and Ustyantsev 2013). Posthumanist theory allows us to make a number of pertinent observations here.

Firstly, the tests being carried out arose from the modern dualist ontology. These tests were conducted with a view to making the world dual. That is to say, they aimed to impose human will upon the inert matter in order to ensure the continued autonomy (or semi-autonomy) of the machines. Secondly, the performative agency of the machine was subsequently overlooked. It appears to have been somewhat of a surprise to many nuclear experts that the machine acted in the world. Indeed, a number of researchers have argued that the way the disaster occurred was a "hypothetically unpredictable, inconceivable accident" (Bregadze et al. 2011; see also Kortov and Ustyantsev, 2013). This is the result of seeing matter as entirely inert and incapable of acting in the world in consequential ways. Posthumanist perspectives, on the other hand, allow us to see that the non-human can act in consequential ways, and that we act in consequential ways in return in a continuous dance of agency until an island of stability is achieved. By embracing the agency of the non-human, and seeing the world and our interactions with it in terms of performance, rather than as a cognitive achievement, we are able to see the how the modern dualist ontology was an integral factor in the disaster.

Because the dualism sees only humans as being capable of agency, the tests aimed to make the world dual without considering material agency. This is key to the whole approach of attempting to make the world dual by dominating matter. The result of this was ignorant to the fact that the world is never made completely dual – the performative agency of the machine still needs to be interacted with. Indeed, as Swanton (2013) has argued, it is remarkable that both the physical and social sciences ignore this continued performative interaction between the human and the non-human after a machine is supposedly completed, because so much time is devoted to maintenance and health and safety measures. Nonetheless, on the day of the disaster, the tests attempted to fulfil the modern ontology by ensuring that the reactor would continue to function according to the will of its staff. It was assumed this was possible, because scientists and engineers had reached a point of cognition which led them to be sure that they had control over the machine's reactivity.

This is how the dualism plays itself out, because the human rationality makes us special, it is assumed that we as humans can reach a point of cognitive understanding that allows us to direct the non-human world (Pickering 2013b). But this is not the case. At Chernobyl, the agency of the machine went unacknowledged due to the dualist conjecture that the experts knew how to control the machine without something unexpected happening. Of course, this approach did lead to something unexpected happening, because it failed to understand that the world does not necessarily bend to human cognition. So experts may speak of the theoretically unforeseeable nature of the disaster, but this is because the modern ontology on which they are basing their argument is flawed. When we shift towards a posthumanist

perspective by considering performativity, rather than cognitive domination, we are able to expect the world to do things back in a continual dance of agency.

The Chernobyl Disaster as a Dance of Agency

The notion of the dance of agency can be explicitly demonstrated in the initial responses to the disaster, even though those responding to it continued to overlook the agency of the non-human. As well as releasing vast quantities of nuclear waste into the atmosphere, the explosion caused a catastrophic fire in the reactor core. Burning at 20000C, the fire melted the core, which still contained 95% of the fuel mass (UN Chernobyl Forum Expert Group 2005). Consequently, fire-fighters were sent to tackle the blaze immediately. However, they initially attempted to put the fire out with water (Kortov and Ustyantsev 2013). Not only did this prove to be wholly ineffective at suppressing the fire, it proved to be a calamitous error because it led to further release of radionuclides into the atmosphere (Gorbachev 2006). Also, the rooms below the reactor began to fill with water. This was highly dangerous because the radioactive lava formed of the melted core, which had a mass of 540 tons, was on the verge of seeping through the concrete flooring into the water-filled rooms below. If this had happened, an even bigger explosion is likely to have occurred, causing lethal levels of radiation (Jaworowski 2010). To prevent this, over 15,000 tons of "neutron absorbing compounds" were dropped on the crater from helicopters, including sand, 40 tons of boron compounds, 600 tons of dolomite and, 2,400 tons of lead (UN Chernobyl Forum Expert Group 2005; Kortov and Ustyantsev 2013). This measure was conducted at huge risk to those involved, as well as huge cost to the USSR. But it quickly transpired that the material being dropped was beginning to melt, thus adding to the mass of the lava which it was supposed to be neutralising. From here, it was decided that a possible solution would be to get miners to dig under the site and build a huge liquid nitrogen room to cool the melted reactor. But this idea was abandoned soon after it was implemented. It turned out that after ten days, the "the fire that had melted the core died out spontaneously" (Jaworowski 2010).

Through the responses to the immediate consequence of the disaster we can see a clear demonstration of a dance of agency, which exemplifies how humans get on in the world more generally. In the case at hand, the humans did something of consequence in the world – they tested the reactor beyond its limits, which led to the non-human doing something in return. This process continued with the resulting fire. With every move taken by human agency to stabilise the disaster, the non-human responded in an unexpected way, which led to the need for a new solution. What becomes obvious from this case is that nature is highly unpredictable. Every time it is was thought to be contained it burst out somewhere unexpected (Pickering 2011). Because of this, the modern dualism quickly becomes less certain. It is not the case that nature is entirely malleable to the human will. Rather than deciding what needs to be done and imposing it upon nature, we engage performatively with the world until

we reach some sort of stability, which arises out of performance rather than cognition – it certainly was not a cognitive achievement that led to the fire going out.

However, the authority of the modern ontology means that a similar story is true of the attempts to mitigate the disaster once the immediate threat from the fire had subsided. By mid-May, 1986, it was discovered that high levels of radionuclides were still being released from the materials in and around the disaster zone (UN Chernobyl Forum Expert Group 2005). So the task of clearing the contaminated areas began. With a team of around 200,000 "liquidators", attempts were made to clear all debris from the exploded core, the surrounding buildings, and the highly contaminated soil (UN Chernobyl Forum Expert Group 2005). Yet again, this was a performative process. As the workers came into contact with the radioactive material, more accurate readings could be taken. This led to the realisation that the dose rate was so high that stronger protection needed to be given to both the workers and their equipment. However, this accommodation proved to be still an inadequate level of protection when the workers were dealing with the most radioactive materials, which were largely located on the roof of the power plant. As a result, it was decided that robots should be used to clear these areas. But the radiation was so high that even the robots started to malfunction. With few options left, it was decided that, regardless of the radiation levels, the liquidators would have to be sent on to the roof to clear the debris (UN Chernobyl Forum Expert Group 2005). But the dance of agency did not end there. The task of disposing of all this debris still remained. Due to the high levels of radiation, storage facilities were planned and implemented hurriedly. This meant that inventories of the facilities and the materials they were housing were not accurate. This caused problems for future attempts to create improved storage structures, meaning that long-term geological storage is estimated to not be ready until 2040 (UN Chernobyl Forum Expert Group 2005).

This narrative of performative dances of agency continues through into the development and implementation of the sarcophagus, which was built to shelter the destroyed reactor, and thus contain further releases of radiation. As with the storage facilities, the shelter was built hurriedly in the race to mitigate the disaster. Again, this led to inaccuracies in recording the shelter's structure and the waste that it contained, which has created problems for maintaining the shelter and for finally decommissioning the reactor (UN Chernobyl Forum Expert Group 2005). Also, in an attempt to reduce exposure to the constructors, much of the welding work was substandard and a lot of the concreting was done via remote control (UN Chernobyl Forum Expert Group 2005). This has resulted in radiation leaking through unforeseen fault lines, meaning that levels of radiation exposure at 150 meters from the shelter are 1000 times higher than the surrounding environment (Kortov and Ustyantsev 2013). On top of this, the shelter is degrading due to corrosion, which has been caused by high levels of moisture. Such high levels of moisture have occurred for two reasons. Firstly, there is an estimated 1000m2 of gaps and openings on the surface of the shelter, which has allowed moisture in. Secondly, a vast amount of liquid dust suppressant has been used in the shelter since its construction (L'Hour et al. 2000). The build-up of moisture seems to be an inevitable consequence of such a measure.

But the liquid suppressant was deemed strictly necessary because of the risk posed by radioactive dust. The dust is so small that it can behave like liquid, in the sense that it can become precipitated. This means that excesses of dust can present a severe risk of radiation releases (Kortov and Ustyantsev 2013). However, it has now emerged that the high levels of moisture presents perhaps a greater threat than the dust. Not only is the shelter corroding, but the collected moisture is now carrying radionuclides as it evaporates and forms condensation, and as it seeps through into the soil underneath the building. It should be noted that the fuel containing material was initially thought to be greatly insoluble, but this has proved to not be the case. Subsequently, high levels of radiation continue to be found in the groundwater surrounding the site, caused by the contaminated moisture leaking into the soil (UN Chernobyl Forum Expert Group 2005).

Yet again, this account not only displays the limits of approaching the world through the modern dualism, but it also displays clearly how posthumanist perspectives provide a much more accurate understanding the entire Chernobyl disaster. The hurried construction of the structure and the need to suppress dust illustrates how human agency is presented with resistances from material agency and therefore accommodations are made – a point which demonstrates the performative interaction of the human and the non-human in the dance of agency (Pickering 1993).

The Continued Emergence of the Disaster

Within these extended narratives of dances of agency, the storage of debris and the shelter also clearly illustrate an ontology of continual becoming. This is a further facet of posthumanist thought which challenges the modern ontology. Rather than seeing that which is as being at some sort of end-point, posthumanism allows us to see how everything is emerging perpetually over time, both physically and contextually (Law and Singleton 2005). What exists at a certain point of time is continually moving into the future in an open-ended symmetry between the human and the non-human (Pickering, 2003). The process is open-ended because what exists at one point does not necessarily determine what will emerge. Chance is endemic in the process of becoming, because, as we have seen with the disaster, what is changes in relation to consequential acts of both the human and the non-human. Regardless of whether these acts are intentional, planned, or unexpected, the emergence of what exists changes over time in relation to these chance acts and encounters (Latour 2014; Pickering 2003). This is certainly the case with the waste storage and the shelter. The two continue to emerge over time, as a result of various chance interactions between the human and the non-human, in a way that has extended the becoming of the disaster into the future in ever new and unexpected ways. The emphasis which posthumanist perspectives put on temporal emergence as an integral way of understanding the world gives us clear picture of how we should understanding the Chernobyl disaster as continually becoming, even today.

There are many ways in which the disaster continues to emerge. In terms of culture, the Sami people of Scandinavia had to adapt many of their cultural practices in the wake of the disaster due to reindeer being contaminated by radiation. This has resulted in the new generations being the first to grow up in the absence of the practices which defined their ancestor's cultural identity (Stephens 1995). Ulrich Beck (1987) also talks of the "anthropological shock" which came with the threat posed by an enemy which is undetectable to our senses. In terms of politics, the disaster's continued emergence can be traced as a causal factor in the collapse of the USSR and the near universal ratification of treaties to halt the proliferation of nuclear weapons (Gorbachev 2006). However, the following will focus on the continued temporal emergence of the disaster in terms of the environment in the area surrounding Chernobyl.

In the immediate aftermath, it was reasonably assumed that the disaster would be catastrophic for the environment. Indeed, this assumption initially proved to be accurate. The explosion and subsequent fire had resulted in widespread contamination of land throughout Europe, with the areas closest to Chernobyl inevitably being hardest hit. This had a number of significant consequences. Firstly, because farmland was heavily contaminated, widespread growth problems in crops occurred in the first harvest after the accident (UN Chernobyl Forum Expert Group 2005). Livestock also suffered. Yields of sheep wool were halved from previous years, widespread thyroid problems were noted, the weight of offspring was low, and early death was frequently reported. On top of this, radioiodine quickly transferred from the soil into milk, which led to many, particularly children, receiving high doses from the consumption of milk (UN Chernobyl Forum Expert Group 2005). This led to millions of people being given stable iodine to prevent poisoning (Jaworowski 2010). Fresh fruit and leafy green vegetables were affected in a similar way, which led to the sale and consumption of these products being prohibited in many countries (Harper 2001). Furthermore, pine forests died back quickly after the accidents and the number of species of invertebrates which live in soil was markedly decreased (UN Chernobyl Forum Expert Group 2005). Even today, there are still marked discrepancies in the reproductive behaviour of many species (Moller, Barnier, and Mousseau 2012). The extent of the contamination meant that a 30km exclusion zone was enforced around the crippled reactor.

For the first few years after the disaster, therefore, it seemed that the surrounding area would be in a state of long-term ecological crisis. However, the open-ended nature of temporal emergence soon came to be displayed. Rather than being completely uninhabitable, the establishment and maintenance of the exclusion zone has resulted in the surrounding ecosystem flourishing. With human life being virtually eliminated from the zone, farming, new building work, and hunting came to an end. Certainly, the old farmland provided an abundance of food for rodents in the early period after the disaster, and the derelict buildings continue to provide shelter for a diversity of species. It seems that the absence of humans tended to outweigh the effects of radiation in terms of increasing populations of animals and plants (Moller, Barnier, and Mousseau 2012). Indeed, over four hundred species of vertebrate animal

have been recorded in the evacuated town of Pripyat (which was a major town in the area of the exclusion zone). This includes "67 ichthyoids, 11 amphibians, 7 reptiles, 251 birds and 73 mammals... more than 50 of them belong to a list of those protected according to national Ukrainian and European Red Books" (Moller et al. 2012). Included in this are species of deer, bears, elks, foxes, grouse, wolves, and boar. Also, by 2005, there were over a hundred beaver families recorded in the zone. As part of a diverse and balanced ecosystem, the beavers in particular have been integral to utterly reshaping the landscape. In the 1920's, the fledgling Soviet Union drained and redirected the vast marshlands in the Chernobyl area, in order to use the land for collective farming and nuclear power. However, within just a few decades of the exclusion zone being established, the damming activity of the beavers has helped to restore the ancient marshes, thus facilitating the restoration of the area to almost how it was in the pre-Soviet era (Moller and Mousseau 2011).

This, coupled with the re-establishment of forests and other natural habits which are unhampered by human activity, has greatly facilitated the return and sustainability of many species which had previously been driven out of the area (UN Chernobyl Forum Expert Group 2005). Naturally, it would be inaccurate to attribute this restoration to the beavers only, as the activity and interaction of the whole ecosystem all contribute. Nonetheless, the chance of restoring and enriching the ecosystem to a similar condition to how it was before humans began to use it to enact their will has become visible. This possibility was seized upon by Biosphere Reserve Askania Nova, who successfully re-introduced twenty-eight highly endangered Przewalksi horses to the zone. The population peaked in 2003-4, with 65 horses. Unfortunately, this has since dwindled due to poaching, but the population remains sustainable (Zharkikh and Yasynetska 2008).

Generally, this sounds very positive from an ecological point of view, but what can be learnt from it? Firstly, it illustrates the continued, open-ended becoming of the disaster. In terms of the environment, the disaster continues to emerge over time in a way that was not determined by the disaster itself. That is, the future of the Chernobyl disaster site as a haven of ecological restoration was not determined by the disaster. Instead, various chance interactions occurred, such as attempting to use water to put out the fire and the building of an inefficient shelter, which mandated the exclusion zone in the first place. When it transpired that the absence of humans had outweighed the effects of radiation, the zone was made into an environmental sanctuary (Zharkikh and Yasynetska 2008). Eventually, the natural ecosystem began to restore itself, which led to the desire for humans to facilitate this process.

We can therefore see how the site of the Chernobyl disaster has undergone a number of physical and contextual changes which have reshaped what the site is as an assemblage (Law and Singleton 2005). Throughout its history, the site has been a marshland that proved to be an obstacle in need of circumnavigation. It has been an intricately canalled piece of land used as a Soviet collective farm. It has then been used as a site to generate nuclear power for the Soviet Union. It has been a disaster zone, in which it became a major contaminator of food supplies and an object of international criticism for slow warnings and dangerous response measures. From

there, it has become exclusion zone for day to day human life. And from there it has emerged as a location of extraordinary ecological restoration, which has since become a nature reserve. This is but a taste of the repeated transformations that the site has undergone. And it seems that the only way to account for these transformations is through a posthumanist perspective. Latour's (1996) approach, in particular tells us that we should see this emergence not as a series of unrelated end points, but instead as a series of assemblages, which only exist at a particular moment time. Within these assemblages, it is essential to understand the symmetry of all aspects involved. Without the very particular interaction of all the various human and nonhuman agencies, the specific assemblage would not be what it is/was. We should therefore understand the Chernobyl disaster and the resulting outcomes as particular assemblages which can only be understand as a chain of multidimensional links which continue to expand from previous assemblages and new actions.[2]

None of this was determined at the time of the disaster – indeed, this particular emergence was so grounded in chance that none of it could be predicted. What we see in the emergence of the ecosystem in the exclusion zone, then, is the continued becoming of the disaster, in which the human and the non-human have hung together in the process of becoming. Neither directed what has occurred; rather, what the site now is has emerged in relation to performative encounters between the two in which the future outcomes could not be foreseen (Asplen 2008).

This point demonstrates something much broader. It demonstrates the flaws of the modern ontology and the integrity of the ontology of becoming, which is offered by posthumanism. To provide an insight into how the disaster has emerged into what it has become is not to construct secure foundations of lineage (Foucault 1984); rather, it is to highlight the sheer accidental multiplicity of a continual emergence which has produced assemblages which are based on heterogeneous chance encounters of performative agency. Such an understanding would not be possible if we see the world in terms of the cognitive achievements of human agency. What the entirety of the Chernobyl disaster illustrates is that the world cannot be pinned down and held still as the modern dualism would have it. The performative engagement of the human and the non-human, and the possibility of chance, means that becoming will not halt. The disaster continues to unfold and so does everything else in the world.

Lessons from a Posthumanist Perspective on the Chernobyl Disaster – Informing Disaster Risk Management

So far, this essay has been discussing how the Chernobyl disaster exemplifies many of arguments against the modern dualism made by posthumanism. While more could still be said from a theoretical stand-point, it seems high time to move on to the practical lessons that can be learnt from applying posthumanist perspectives to the Chernobyl disaster. Indeed, as Pickering (forthcoming) points out, action and ontology reinforce each other. How we act in the world and how we understand it support one another. How humans have acted for the most part throughout modernity

has been to "enframe" the world, as Heidegger (1977) called it. That is, we have attempted to bend the world to our will. And we have done this because how we think about the world has been underpinned by the modern dualism (Pickering forthcoming). This project of enframing would be fine if the world actually was how the modern dualism describes it to be. But, as we have seen with the Chernobyl disaster, the world does not simply passively await the imposition of our will. Through the application of posthumanist perspectives, we have seen that this is not how the world is. So, with this alternative approach to seeing the world can come alternative ways of getting on in the world. I suggest that there are two major lessons to be learnt from a posthumanist perspective on the Chernobyl disaster. The first is to do with how we can mitigate potential disasters in the future; the second is how to approach matters of ecological calamity.

The first lesson that can be learnt from a posthumanist understanding of Chernobyl is that we should respond to disaster risk management from a posthumanist perspective. It could perhaps be suggested that attributing agency to nonhumans casts a shadow over the necessity of responsible action – if nonhuman actants are going to respond in an unexpected way, how can we know that we are acting in the right way? Indeed, Bloor (1999) argues that Latour's attempt to provide symmetry of agency negates the fact that objects do have a definite existence which affects people's lives in certain ways. Essentially, what Bloor is saying is that it is all well and good suggesting that things like nuclear power stations are made up of multidimensional links, conceptual frameworks and interactions of agency, but outside of theory, they are real things which pose real dangers and mandate particular courses of action. However, posthumanism does not suggest that humans are incapable of learning and of following guided intentional action – indeed, it seems that Latour (2008) would consider these factors to be essential elements of many actor-networks. What is suggested by posthumanism is that, by seeing the non-human and the human as existing in a performative dance of agency, we are able to account for all relevant aspects of an assemblage and we can expect things to go contrary to our perpetual domination of them. And with this approach, we are able to better conceptualise the risk posed by assemblages (Neisser, 2014).

Certainly, Neisser (2014) suggests that posthumanist approaches are well suited to the field of disaster risk management. This is because "[d]isaster risk management aims at reducing or avoiding losses and assuring efficient and effective response recovery" (Neisser, 2014). Taking this task seriously requires an understanding that a multitude of aspects, such as natural, technological, social, and economic causes are all of relevance to understanding the risk posed by disasters. In fact, approaching disaster risk management in this fashion was a key aspect of the United Nations Office for Disaster Risk Reduction's Hyogo Framework for Action, which came into effect in 2005 (Neisser, 2014). Posthumanist perspectives, especially ANT, are inherently well suited to such an approach, because they are able to consider disasters as complex assemblages, in which neither the human nor the nonhuman are given priority.

Neisser (2014) suggests two ways in which posthumanist perspectives can be implemented into disaster risk management. Firstly, it can facilitate the consideration of constituent elements of an assemblage when planning or carrying out a risk venture, which can yield a clearer view (although not absolute certainty) of possible and likely eventualities. In terms of practice, this would involve analysis of how the interaction of human and non-human agency is likely to occur according to the performative repertoire of all the constitutive elements. Naturally, this approach involves an understanding that it is not just humans that are capable of action. It also involves a recognition that we should not assume that the non-human will simply bend to our will. Within this should be an intrinsic recognition that some projects will be simply too risky to be responsibly undertaken. Pickering (2011) recognises that the more complex it becomes to find an island of stability, the greater the danger posed if stability is compromised. Nuclear power is a good case in point: the complexities involved in bending atoms to our will means that the dangers involved are high should something go contrary to how humans want it to go (and there is always a chance of this happening). This message seems to have been heeded in Germany, where their nuclear power programme is being brought to an end in the wake of the Fukushima disaster (Beck 2012). So in this sense, posthumanism can be applied to disaster risk management by emphasising the necessity of accounting for the agency of all constituent elements of a risky endeavour, as well as breaking with the notion that we will be able to control everything if we have the correct cognitive achievements, which in turn allows us to recognise that some project are simply too risky.

Secondly, Neisser (2014) argues that posthumanism can inform disaster risk management because it can be used for retrospective analysis of previous disasters. In turn this can inform future planning. To be sure, a retrospective analysis of the Chernobyl disaster is precisely what has been provided above, and it is hoped that this analysis can be added to the conversation of how we respond to such disasters in the future. Applying posthumanism to the Chernobyl case has shown that failure to recognise the both the multidimensionality of the disaster, and the fact that the human and the nonhuman are each able to act in consequential ways which emerge perpetually through dances of agency, was an integral aspect of the disaster itself and of the subsequent botched responses. Thus, unless we genuinely consider the interaction of multidimensional human and nonhuman agency, then there is a good chance that we will continue to put ourselves in more risky situations, and we will continue to struggle to deal with the consequences effectively. In this sense, it becomes clear that applying posthumanist perspectives does not have to be purely high-mind philosophising. It can actually produce clear conceptual frameworks which are necessary to accurately accounting for, and responding to, real world disasters. As has been indicated by the emphasis the Hyogo Framework put on multidimensional understandings of disaster, there is no reason why posthumanism should not inform responsible disaster risk management policy and practice.

The point is this. The modern ontology fails to correctly account for how disasters unfold and how they should best be responded to. Posthumanism, however, is able to understand the multifaceted nature of the risks posed by disasters and the responses to

them. If it is true that disasters can be understood as multidimensional assemblages, then it becomes clear that the best way to guide policies of risk management is through posthumanist perspectives of the world. It is here that we see how ontology and action hang together: seeing the world through a posthumanist lens allows risk management policy to become able to recognise disasters as involving dances of agency between the human and nonhuman, in which all aspects are taken into consideration. When this approach is fully adopted by disaster risk management policy, then what is considered to be sound practice in the field can also change.

Lessons from a Posthumanist Perspective on the Chernobyl Disaster – Informing Responses to Ecological Problems

Additionally, a lesson can be learnt from the environmental progress of the exclusion zone. The restoration of the natural ecosystem that has occurred in the absence of humans illustrates a new way to face environmental crisis, particularly when coupled with seeing the world in terms of performativity and emergence. The continued becoming of the Chernobyl disaster in the exclusion zone has made it clear that it is counter-intuitive to mitigate ecological disasters through further domination, as nature will largely do things successfully in our absence. Instead, if we can engage with the environment performatively, in the knowledge that the environment is continually emerging and that most of what is needed can be drawn from nature (Pickering 2013b), policies of "ecological restoration" become a sound option to follow (Asplen 2008).

Following Asplen (2008), it seems that the major problem of environmental policies throughout the modern period has been our attempts to "command and control" nature in such a way that it does what we want it to do. Yet again, this approach overlooks the performative engagement of the human and the non-human. As a result, such approaches have largely failed. Pickering (2008b) uses the interactions between the US Army Corps of Engineers and the Mississippi river to exemplify this point. Every time the Army attempted to do something to the river to make it supposedly more manageable, the river responded in an unexpected way. As we have seen, this unpredictable performativity is indicative of the world we live in. So, this being the case, what can be done when engaging with environmental disaster? Asplen (2008) highlights the rise of ecological restoration as an alternative way to work with the environment. This policy involves restoring the integrity of an ecosystem, with the aim of restoring the health of the system. To achieve this, the ecosystem in question will be worked with in a way that does not involve domination. Humans simply play a facilitating role, such as reintroducing native species. There is also a strong emphasis on learning from the system, in order to see how it moves to progress (Asplen 2008).

Although this was not necessarily a policy in the aftermath of the disaster, the restoration of the ecosystem in the exclusion zone exemplifies perfectly what can be achieved from posthumanist approaches to the environment. When such approaches

are embraced, the necessity of human control is brought into question. What becomes clear is that nature, in most cases, can restore itself with minimal imposition. And what subsequently can be learnt from this is that this is precisely how we should engage with the environment when it is at crisis point. The modern ontology of domination that has put our world at so much risk from environmental disaster (whether it be exploding reactors or drastic climate change) that alternative ways of going on must be implemented. And this alternative is offered by ecological restoration and demonstrated by the Chernobyl exclusion zone. However, for practices to change, our ways of understanding the world needs to change. It seems that posthumanist perspectives offer this amendment, and if we want to live in a world of reduced environmental risk, then we need to live in a world which is free from the fallacious notion of our own human specialness which has mandated us to bend the world to human our ends.

Conclusion

To conclude, this essay has attempted to show how posthumanist perspectives give a more complete understanding of the Chernobyl disaster than could be presented by approaches that are have arisen (perhaps unknowingly) from the modern ontology. Through their application to the Chernobyl case, this essay has attempted to demonstrate the more general value of posthumanist theories as a challenge to the modern ontology. The application of posthumanist theories not only show that the modern ontology is incorrect, but that it has also had dangerous consequences. The non-human is not simply passive in its relationship with the human. It was this attitude that led to the Chernobyl disaster and this attitude that has brought our environment more generally to the brink of collapse.

As we have seen, the disaster arose out of the modern ontology dualism, because the unpredictable performativity of the non-human was not taken seriously enough. While the tests which led to the disaster naturally recognised the need to engage with the performativity of the reactor, these tests were conducted under the assumption that the engineers had achieved a level of cognition which allowed them to control and predict how the machine would react. This, of course, turned out to not be the case. A posthumanist perspective on the Chernobyl disaster allows us to recognise that the non-human, as well as the human, has a performative agency which is unpredictable. When we recognise this non-human performativity, we are able to recognise that how we act in the world is not directed by a series of cognitive achievements which allow us to control the non-human.

Indeed, the recognition of non-human agency allows us to see the human and the non-human as being engaged in a performative dance of agency. Understanding the world as a process of reciprocal action and response between the human and the non-human provides a clear account of how the initial responses to the Chernobyl disaster unfolded. Humans did something consequential, and the non-human responded in a consequential way. It certainly was not a case of those responding to the disaster

establishing and then enacting a foolproof plan. Rather, it was a performative process in which certain response emerged as certain actions were taken, which led to the need for new action. Providing a retrospective analysis of the Chernobyl case allows us to understand that a failure to recognise the disaster as a temporally emergent assemblage which is constituted by multifaceted interactions of human and nonhuman agency was a key factor in the inadequate assessment of the risk posed by the tests, and the subsequent inadequate responses.

From here, we get a clear example of how applying posthumanism to disaster risk management can improve policy and practice. The more we understand that disasters are assemblages, the more that we can understand the risk posed by it. As posthumanism teaches us, each multidimensional linkage is integral to the assemblage, meaning that each linkage needs to be given credence when considering risks. Thus, if we consider each multidimensional aspect of a disaster without lending priority to either the human or the non-human, we are able to gain a clear picture of how a disaster has unfolded and which responses are most likely to mitigate further devastation. This is how a shift of ontological perspective, from the modern dualism towards posthumanism, can affect policy and practice in real world disaster responses. Perhaps the most important step in bringing this about is the recognition that the non-human has agency. Until we shelve the view that it is only us humans who are able to act in consequential ways in the world, we will be unable to fully conceptualise the risks that disasters pose.

In addition to this, the Chernobyl disaster, almost unbelievably, has continued to emerge in such a way that it also offers us a new path to deal with ecological disaster. Applying posthumansim allows us to trace the disaster through the explosion, the immediate responses, the later responses of the waste disposal and the building of the shelter, and on to the ecological transformation, and it allows us to understand how this continued becoming has emerged with neither the human nor the non-human being considered as the singular director of the change. The disaster has emerged in relation to performative encounters between the two, and in this process chance has been endemic. Indeed, this is certainly the case with the ecological restoration that has been achieved in the exclusion zone. That the exclusion zone has become a par excellence example of the value of ecological restoration could not have been predicted or enacted during the initial consequences of the disaster. In a strange twist, we can view the continued emergence of the Chernobyl disaster in the sense that it now provides an insightful illustration of how posthumanist perspectives can be applied to ecological disaster. The notion that we should work with nature, rather than try to dominate it, is a prime example of how posthumanism can inform policies on ecological catastrophe. Recognising the significance of non-human agency allows posthumanism to recommend that, rather than attempting to control nature, we can work with it and allow it to take the lead. And, oddly enough, the exclusion zone offers evidences of how and why ecological restoration is perhaps the best approach to follow.

In short, in its challenge to the modern ontology, posthumanism gives us a new way to go forward. If disasters such as Chernobyl teach us anything, it should be that

we need a new way to go on. Posthumanism offers this new way forward by challenging the modern ontology. This is the essential, because without viewing the world differently (perhaps read "more accurately"), we will never be able to find a new, less risky, way of facing disasters and being in the world more generally.

Notes

[1] It should be noted that posthumanism involves displacing the human subject from its centre of human exceptionalism. It is not 'anti-humanism', which would aim to dispense with the human subject altogether (Pickering 1993).

[2] Latour (2014) stresses that new theories and conceptual frameworks also add to a particular actor-network. This is the subject of some disagreement (see Bloor 1999; Elder-Vass 2015). However, while it may be interesting to insert that Latour's theory implies that this essay will be adding to the assemblage of the Chernobyl disaster, this debate will not be the subject of this essay.

References

Asplen, L. 2008. "Going with the Flow: Living the Mangle in Environmental Management Practice". Pp. 163-184 in The Mangle in Practice: Science, Society and Becoming, edited by A. Pickering, and K. Guzik. Durham: Duke University Press.

Beck, U. 1987. "The Anthropological shock: Chernobyl and the Contours of Risk Society." Berkley Journal of Sociology 32: 153-165.

---. 2012. Twenty Observations on a World in Turmoil. Polity Press: Cambridge.

Bloor, D. 1999. "Anti-Latour." Studies in the History and Philosophy of Science. 30 (1): 88-112.

Bregadze, Y.I., V.I. Vinnik, E.K. Stepanov, and V.P. Yaryna. 2011. "On the 25th Anniversary of the Disaster at the Chernobyl Nuclear Power Plant." Measurement Techniques 54 (4): 3-5.

Elder-Vass, D. 2015. "Disassembling Actor-Network Theory." Philosophy of the Social Sciences. 45 (1): 100-121

Foucault, M. 1984. 'Nietzsche, Genealogy, History'. Pp. 76-97. in The Foucault Reader: An Introduction to Foucault's Thought, edited by P. Rainbow. London: Penguin.

Gorbachev, M. 2006. Turning Point at Chernobyl. Project Syndicate. Accessed March 23rd, 2014. (http://www.project-syndicate.org/commentary/turning-point-at-chernobyl)

Haraway, D. 1992. “The Promise of Monsters: A Regenerative Politics for Inappropriate/d Others.” Pp. 295-337. in Cultural Studies, edited by L. Grossberg, C. Nelson, and P.A. Treichler. New York: Routledge.

Harper, K.M. 2001. “Chernobyl Stories and Anthropological Shock in Hungary.” Anthropological Quarterly 74 (3): 114-123.

Heidegger, M. 1977. “The Question Concerning Technology.” Pp. 3-35. in The Question Concerning Technology and other Essays. Edited by M. Lovitt. New York: Harper and Row.

Jaworowski, Z. 2010. “Observations on the Chernobyl Disaster and LNT.” Dose Response 8: 148-171.

Kortov, V. and Y. Ustyantsev. 2013. “Chernobyl Accident: Causes, Consequences, and Problems of Ration Measurements.” Radiation Measurement 55: 12-16.

Latour, B. 1996. “On Actor-Network Theory: A few Clarifications.” Soziale Welt 47 (4): 369-381.

---. 2003. “When Things Strike Back: A Possible Contribution of ‘Social Studies’ to the Social Sciences.” British Journal of Sociology 51 (1): 107-123.

---. 2005. Reassembling the Social: An Introduction to Actor-Network Theory. Oxford: Oxford University Press.

---. 2014. “On Recalling ANT.” Sociological Review 47 (1): 15-25.

Law, J., and V. Singleton. 2005. “Object Lessons.” Organization Articles. 12 (3): 331-335.

L’Hour, A. M. Giorgio, M. Ball, and A. Korneev. 2000. “Dust Control inside the Chernobyl Nuclear Power Plant Shelter during Emergency Conditions.” WM ’00 Conference. (http://www.wmsym.org/archives/2000/pdf/47/47-7.pdf) Accessed 23/08/2016

Moller, A.P. and T.A. Mousseau. 2011. “Conservation Consequences of Chernobyl and Other Nuclear Accidents.” Biological Conservation 144: 2787-2798.

Moller, A.P., F. Barnier, and T.A. Mousseau. 2012. “Ecosystem Effects 25 years after Chernobyl: Pollinators, Fruit Set and Recruitment.” Oecolgia 170: 1155-1165.

Neisser, F.N. 2014. “‘Riskscapes’ and Risk Management – Review and Synthesis of an Actor-Network Theory Approach.” Risk Management 16: 2: 88-120.

Pickering, A. 1993. “The Mangle of Practice: Agency and Emergence in the Sociology of Science.” American Journal of Sociology 99: 559-89.

---. 2005. “Asian Eels and Global Warming: A Posthumanist Perspective on Society and the Environment.” Epistemology and Environmental Philosophy, special issue of Ethics and the Environment 10: 29-43.

---. 2008(a). “New Ontologies.” Pp. 1-16. In The Mangle in Practice: Science, Society and Becoming, edited by In A. Pickering, and K. Guzik. Durham: Duke University Press.

---. “Culture, Science Studies and Technoscience.” Pp. 291-307 In Handbook of Cultural Analysis, edited by T. Bennett, and J. Frow. London: SAGE.

---. 2009. “The Politics of Theory: Producing Another World, With Some Thoughts on Latour.” Journal of Cultural Economy 2: 197-212.

---. 2011. “Ontological Politics: Realism and Agency in Science, Technology and Art.” Insights 4: 2-11 Access 23/08/2016 (www.dur.ac.uk/resources/ias/insights/Pickering30Jan.pdf)

---. 2013(a). “Living in the Material World.” Pp. 2-16. in Materiality and Space: Organizations, Artefacts and Practices, edited by F. Devaujany, and N. Mitev. London: Macmillan.

---. 2013(b). “Being in an Environment: A Performative Perspective.” Natures Sciences Sociétés 2: 77-83. Accessed 23/08/2016 (http://dx.doi.org/10.1051/nss/2013067)

---. Forthcoming. “Neo-sigma: Art, Agency and Revolution.” in Cybernetics Revisited, special issue of Leonardo Electronic Almanac, edited by M. Søndergaard.

Rae, G. 2014. “The Philosophical Roots of Donna Haraway’s Cyborg Imagery: Descartes and Heidegger Through Latour, Derrida, and Agamben.” Human Studies 37: 505-528.

Sayes, E. 2014. “Actor-Network Theory and Methodology: Just What Does it Mean to Say That Nonhumans Have Agency?” Social Studies of Science 44 (1): 134-149.

Stephens, S. 1995. “The ‘Cultural Fallout’ of Chernobyl Radiation in Norwegian Sami Regions: Implication for Children”. Pp.? in Children and the Politics of Culture, edited by S. Stephens. New Jersey: Princeton University Press.

Swanton, D. 2013. “The Steel Plant as Assemblage.” Geoforum 44: 282-91.

UN Chernobyl Forum Expert Group “Environment”. 2005. Environmental Consequences of the Chernobyl Accident and their Ramifications: Twenty Years of Experience. IAEA: New York.

Zharkikh, T.L. and N.I. Yasynetska. 2008. “Demographic Parameters of a Przewalski Horse (Equus Przewalskii Polj. 1881) Population in the Exclusion Zone of the Chernobyl Power Plant.” Bulletin of Moscow Society of Naturalists’- Biological Series 113: 5: 3-9.