Data that warms: Cultural and Material Transformations of (big) data[1].

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This paper is about the technical infrastructures behind big data. Here, I will discuss some recent developments in these infrastructures which I see as catalysing significant transformations in the **cultural meaning, materiality and the value of digital data.** It is a topic that is a bit on the side from my dissertation project, but which I found quite interesting so this presentation is a very preliminary attempt to sum up some thoughts and ideas on the topic.

I would like to start by briefly introducing to you a practice that we normally do *not* associate with big data, but which is deeply relevant to the debates that surround it. It is a practice which, in the world of computer generated digital visual media is called **rendering.**

It grabbed my attention while I was doing participant observation among computer graphics artists, animators and programmers in Amsterdam and Gorno-Altaysk in Siberia. **Rendering** was something that people were very seriously concerned with all the time in the course of the film productions.

What is rendering?

In their work, computer graphics artists use specialised software in order to create digital models of different objects. They first make a drawing of an object, then they do a digital sculpture of it, then they add properties to it such as light, texture, viewpoint and shades. This is something that is done for each and every object in a scene. If a scene is going to be part of an animation, there are placed additional descriptors that indicate what is going to move and how.

Once defined, these properties need to be computed in order to produce the final image that we will see. The process of computing is what is called **rendering**. *Any* computer generated image needs to be rendered.

Depending on how complex and realistic the image or the scene is, the computer power that is needed to compute the image can vary.

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For example, for a wealthy animation producer like Pixar which aims at high production values, it takes an average of 6 hours to render one frame of scene of an animated film[2]. A 90 min film has about 130 000 frames of animation (which means about 780 000 hours of rendering or about 32 500 days – this is just computing time). This is obviously unfeasible, so they cluster computing power in so called renderfarms.
For films that Pixar produced in 2012, e.g. Monsters Inc. they used 2 000 computers with more than 24 000 cores, or the equivalent of one supercomputer in order to compute the film. I find such numbers to be completely stunning considering that all this computer power goes for producing entertainment, symbolic media that is enjoyed probably once or twice.

Now, since not everybody has this computing power, what creators usually do is to go about using the services of **online rendering farms**. These farms usually operate as part of data centres and cloud computing infrastructure and share their computational capacity which is divided between three different services: so cloud storage; data processing of transactional data from our online activity, and computer graphics rendering.

Because of this infrastructural co-existence, emerging big actors in this area of online distributed renderpower are, unsurprisingly, Google, and Amazon

The problem with heat

The biggest problem that such centers face is the heat that is emitted from the computers that constantly compute. In this respect, we could think of the data flows that go in and out of such data centres as rather literal examples McLuhan's (1994) metaphor of hot and cold media, generating physically extreme heat that needs to be constantly cooled off.

The dynamic of heating and cooling data infrastructures has raised concerns among researchers and environmental activitsts in terms of the sustainability of the computer industries. Particularly problematic is the environmental impact of the digital surveillance industries which are regarded to be some of the main actors that overconsume natural resources for the sake of maintaining regimes of hypersurveillance.

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2 http://pixar-animation.weebly.com/pixars-animation-process.html

Of course, to this we can add the rendering services which are a significant producer of such heat, and extend this concern with adding the digital entertainment media industries as a notable actor that aggravates the problem.

The ways in which the problem with overheating is solved is by either using water for cooling computers down, or by placing data centres in geographically colder locations such as those in the Arctic climate zone. There has been done some very interesting research on this topic, for example by Mel Hogan (2015) who pointed out at the overuse of water by the NSA data centre in Utah, a region that is generally very dry; or by Asta Vonderau who looked at Facebook’s data centre in the city of Luleå in Northern Sweden.

For my purposes I will discuss another actor, which is the French company Quarnot computing which is solving the problem with overheat in a different way.

Cases

Quarnot computing is a French company based in Paris that operates a distributed renderfarm and generally offers online computational power for data processing.
The company has created a so called “smart” heater, which it presents as “a fusion of an electrical heater and a high-performance computer server” (Quarnot’s website). The heater is called Q.RAD and produces heat by computation. It generates heat when being put to compute data for, primarily 3D animation studios, but also banks and research labs. The electricity consumption is measured by an embedded counter. Related expenses are automatically refunded to the host….So, the consumer does not need to pay anything for the heat, it is the person or company that requests the computational service that does it.

One such heater is said to be enough to heat up a room of 13 – 27 sq meters in a building with modern isolation standards. It is also presented as producing nicer sensory experience, creating “a high quality "soft" heat as opposed to electrical convectors.”

Since 2014, the company has installed 350 such heaters in Paris apartment blocks where they heat about 100 households. Heaters are also placed in school buildings which are strategic because in hot summers the space can continue to be heated without disrupting the computational process, because people would otherwise probably reduce the heating. Spare capacity in winter is sometimes offered to universities.
The heater has no noise, and produces power that is equivalent to about 500 W.

Other cases

This example is not unique.

Since 2013 the national Swedish internet provider Bahnhof started rerouting the excessive heat that its data centres generate into the district heating system of Stockholm. Since then, Bahnhof has expanded tremendously its data processing infrastructure. All new data centres that are built, are positioned in a direct proximity to the pipes of the district heating system. And today, the heat created by processing data warms the homes of the inhabitants of several densely populated districts of Stockholm, such as Norra Djurgården; Hammarby Sjöstad and Akalla.

Bahnhof and its partner, Fortum, which is the company that operates the pipes of the district heating see their work as a way to offset the industry effects on global warming, "and get paid for that". Whenever the outside air temperatures get below +7 degrees Celsius (44F), which in Stockholm is the case for around half the year, switching to heating from processing data is profitable (Fortum n.d.)

The profitability of heating through data streams seems also to be fueling corporate imaginaries about the future of data processing. The executive director of Bahnhof describes this future as being "not in the countryside, it is in cities with a well connected district heating system" (Bahnhof 2015).

Similar development can also be tracked in Germany where a Dresden based company introduced last year a new service called Cloud & Heat and promises to heat sustainably and smartly urban homes.

As such, these examples are significant for a broader trend in which data processing infrastructures are currently being interconnected with infrastructures of the urban district heating systems.

How to think of this developments?

I will propose some ways in how to think about these developments.

Now, in her study of the cable infrastructures of the Internet, Nicole Starosielski (2015, 18) points out that global communication flows are dependent on the need for putting the infrastructural network that underpins them into balance, in order to offset disturbances.

The ways in which this balance is achieved, she suggests, is through “strategies for interconnection”, which refer to the “development of fixed architectures and spatial practices through which transfers between the cable system and its surrounding environments can occur” (18). The cultural geographies into which communication infrastructures are inserted represent critical links that produce global communications and are simultaneously places where signals are grounded, and in which infrastructures get stabilised. In the contexts of the Internet cable infrastructure, Starosielski suggests that such strategies have included as much technical solutions, so as cultural – such as, if looking back in history, arranging marriages which, she argues, “helped to sustain the operators and therefore stabilise transoceanic signal traffic in remote locales” (19).

From this perspective, the ongoing intense interconnection of big data infrastructures with district heating systems can be seen as strategies that aim to offset threats to the networked infrastructures of big data. The ways in which this is done is by transforming data materially and culturally and ultimately redefining its value, by making its production and perpetual flow relevant beyond the sphere of the digital.

Materially, big data streams are transformed from bits of numbers and electrical signals into heat that re-enters our private space in a different form and way, providing an enhanced sensory experience of our environment through “a nicer "softer" heat as opposed to heat created in other ways. This transformation is simultaneously a strategy for stabilising the network, by eliminating the direct, immediate physical threat of overheating the machinery.

There is also a change in the ways in which we imagine the big data processing industries. From seeing them as a threat to our privacy and digital lives, they are redefined culturally into **desired** infrastructures that we **need** for a sustainable, fossil-free future. As such, data processing infrastructures come to produce specific citizens, responsible consumers that have to keep creating data for the better of everyone’s well being.

In this context, what finally happens is a change in the value of data. Data is constructed materially, and culturally as equivalent to a raw material, a form of a natural resource that is comparable to coal, water, or more recently garbage that are used for heating. Consequently, digital data starts being valued by data centres once as a source of content or information that can be valorised back online, and twice, as a raw material that has to flow perpetually in the network in order to stabilise it, irrespective of its meaning.

Final words on the possible implications

First, instead of addressing the fundamental issues of big data production, such as privacy, surveillance, and the computational power that goes into producing entertainment media, these practices bypass the problems totally. Instead, they stabilise them by making us dependent in new ways on the constant, uninterrupted production of data, and framing it as desirable for a sustainable future.

Secondly, they boost cultural and economic practices that are based on the idea of computing and crunching numbers for the sake of computing. We can think of it as a new phase in the formation of what Ted Striphas (2015) called recently an “algorithmic culture”.

To the extent that infrastructures tend to sink down, and these novel computational practices are way too abstract and complex to comprehend by the broader public, they form a perfect ground for new constellations of digital power to emerge.