Eating Processes:

How a redefinition of food can help solve food problems

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Abstract

Today's food related problems are vast and often deeply complicated. The amount of problems attributed to food production, consumption and distribution are only surpassed by the amount of proposed solutions that each offer their own way of dealing with the many problems and challenges.

The solutions offered hinge upon a certain mode of thought when thinking of food. A particular perceptual framework of food govern much of the research, methodology and solutions concerning food. It is this framework that the paper seeks to identify, analyze and subsequently propose an alternate framework of how to perceive food.

The STS (Science, Technology & Society) modus operandi has been essential in framing and guiding the research of the paper. The proposed solution is based on the works of Bruno Latour and his inspiration of processes and relational thought, the works of Alfred North Whitehead. The focus of STS to always shift perspectives, no matter on how big or small a scale forms the foundation of the paper. The theories of Thomas Kuhn are in this regard deployed to frame, guide and provide encouragement that definitions are not fixed in stone.

The paper looks at two prevalent definitions of food. Definitions that in turn dictate and direct problems and solutions to food. They both suffer from the same common notion in that they view food as objects that can be broken down, and that only exist in one particular moment in time, making them seem unrelated to their manufacturing, distribution and consumption.

The proposed solution is to view food as processes instead of objects with fixed parameters. By viewing food as a process a temporal dimension to food appears that relates all food to their origin and their final destination. In this way food becomes more than mere objects. It becomes a link in a chain that we are all part of and all have influence upon.

As the paper draws heavily on the works of Whitehead who was inspired by relativity theory and the emerging quantum physics this paper also makes use of drawing comparisons between food and the field of physics in an attempt to narrow the gap of the social and natural sciences.

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Introduction

This paper is about food. It is not a recipe collection for making specific kinds of food though but recipes of approaches of how we perceive food. Food is a fundamental ingredient in human life, and has as such as many definitions and opinions as one has the time to collect. For some food is pleasure, for some it is a necessity, for others it is an inconvenience and for still others it is a way of living. Food is also the tomato in the garden, the steak on the plate, and the mushroom found beneath the leaves on the forest floor. For the physicist food is measured as the energy needed for the human body, for the host of a dinner party, it is the highlight of the evening, where one gathers friends and family for a cozy get-together.

When I first started researching food these were some of the many definitions and categorizations I found. My initial curiosity was related to the formation of the organic food movement which started in the beginning of the twentieth century. The organic food movement has since grown in scale as well as scope, and I wanted to investigate if Robert Malthus' thesis on the earth's carrying capacity was relevant (or irrelevant) with regard to organic food.[1] I.e. was organic food even a contender with respect to carrying capacity and able to replace the modern industrial food system?

The question of what organic food is proved a difficult question to answer however. Organic food is laden with as many opinions and definitions as industrial food is. To be sure there are standards and exact regulations that define organic food with legal repercussions, but even these standards are prone to be redefined and even circumvented on a case by case basis.

[1] As put forth in *An Essay on the Principle of Population (*1798*)* wherein he argued that population growth will surpass the supply of food.

The philosophy and ideology governing the organic food movement is also difficult to untangle, ranging from sustainability and health of humans, to environmental issues, to animal ethics and economic perspectives.

As the research progressed it became clear that it was easier to define organic food not by what it is, but by what it is *not.* By performing this inversion[2] it also became clear that the organic food movement is a reaction to the industrial food complex. In many ways it sees itself as an antithesis to the industrial food complex, but in this way it is also part of the very same complex as it tries to remove itself from. The use of rhetoric and argumentation devices, the science of food and indeed philosophy of food within the organic food movement piggybacks, as we shall see, on the history of industrial food.

The question then was not how to approach only organic food, but how to understand food as a whole. The organic food movement can in this respect be viewed as an important reaction, constantly highlighting and problematizing contemporary and future food concerns. This paper examines the modern industrial food complex and contrasts it to the organic food movement in order to arrive at a proposal, as to how we can redefine our perception of food and how this suggestion can help alleviate the many issues of food on a practical level, as well as change the perception of food on an abstract level.

Problem statement

This paper examines how a redefinition, a new metaphor, of food can help solve problems within the food system through an investigation of two food systems:

[2] Susan Leigh Star and Geoffrey C. Bowker use the word "inversion" to indicate the act of revealing an underlying (or overlying!) infrastructure that a phenomenon is part of (Star & Bowker, 1999).

- The industrial food complex
- The organic food movement

The problem is thus twofold: On the one hand the paper untangles why a redefinition of food is in order, effectively describing the metaphysical framework of the current definitions. On the other hand, it seeks to highlight food related problems that this very framework is causing, and suggests how a new framework can put these problems in another perspective.

The case

The field of food is enormous. A Google search of the term yields an excess of two billion hits. It is important in this regard to have relevant and concise information in respect to one's questions about food. This paper's first method of containing and eliminating irrelevant information and staying in focus, is the insistence of organic food being a counter-action to the modern way of growing food. *The Encyclopedia of Organic Food and Farming* has in this regard been indispensible to framing overall issues that exists within the modern industrial food complex. Other works such as the seminal work by Rachel Carson's *Silent Spring* from 1962 and Michael Pollan's *Omnivores Dilemma* and *In Defense of Food* have given insights into specific issues regarding food production, handling and consumption. The research on food, e.g., concerning health benefits, is far reaching and sometimes not suited for non-professionals not well versed in biology and chemistry. It is therefore beneficial to read summaries of the findings such as the Soil Association publication *Organic Farming, Food Quality and Human Health* drawing on over 400 peer-reviewed articles on organic food and consumer trends. Marion Nestle's *Food Politics* gives a detailed and often firsthand account of the politics regarding food

politics both on a governmental and on a corporate level. These books present the major empirical framework upon which the paper builds its case.

Many works dealing with specialized issues concerning food have not been included or their contents have not been considered in this paper. Not only because they require a substantial amount of knowledge of chemistry and biology, but because their scope is simply too narrow and specialized. Literature dealing with specific food issues such as e.g. obesity, sustainability, or dangers to our food from certain kinds of chemicals deal with specific issues with very limited parameters in mind. The object of this paper however, as will become clear in later chapters, is not of solving food problems on a case by case basis but rather a move toward a change in the systemic perception of the entire field of food, which in turn indeed can help specific food related problems. If this paper were to delve deeper into the problems raised by such literature the focus of the paper would be blurred and even worse, the paper would indirectly still be maintaining and navigate within the same metaphysical view of food that it has set out to critique. The paper thus uses only specific examples from the field of food to highlight how to approach problems within the field of food and to draw attention to the conventional view of food.

As most of the empirical data pertains to studies and observations performed in the western culture, USA and EU and the countries within their cultural influence in particular, the paper should be read with this limitation in mind. If particular data is deemed important to geographical clarification this will be noted.

The theoretical framework underlying the case is the notion that Science and Nature is a construct of human interaction, negotiation as well as experimentation; ideas concretized by

e.g. Thomas Kuhn and Bruno Latour. The suggestion to a new perspective of looking at food is heavily reliant on Latour's insistence on changing the views on existing categories and dichotomies. It also pays homage to one of Latour's inspirational sources for his processual and relational thought, the writings and philosophy of Alfred North Whitehead.

Definitions

A few definitions of words and phrases that are used in the paper are in order. The words of Nature and Science (capitalized) are used throughout the paper denoting the abstract unspecified aspects of the two terms, un-capitalized they denote the individual sciences, like mathematics etc.

In describing the modern industrial food complex and the organic movement the paper uses slight variations of the phrases for stylistic purposes. The important thing to have in mind is not the difference in the wording of the phrases, but the concepts that the phrases encapsulate. By the term "food complex" I aim to encapsulate the prevailing school of thought and the production and distribution mechanics related to the particular food.

Lastly there is the matter of articulating the constructivist viewpoint in print. That is to avoid describing research as "discoveries" and circumventing the use of words like "facts". I have found it important to aggressively find new rhetorical formulations for words like these to better maintain the constructivist focus and mode of thought. The act of actively engaging and problematizing instances of e.g. "facts" is sometimes difficult to convey in a graceful manner in print, because of the long tradition that has ingrained these words with authority.

Outline

This paper has five main sections. Following the introduction, the theoretical framework of the paper is presented. I have sought to build up a logical progression of the framework starting with Kuhn and Latour and ending with Whitehead. In the third section two metaphors for food are presented, the mechanical and food seen as an organism. The fourth section presents a new definition of food, the metaphor to view food as a process. The final section discusses the paper's approach in a larger context. The paper ends with a conclusion of the findings.

Theory and concepts

The following section presents the theoretical framework upon which the paper rests. The paper draws mainly on the works of Thomas Kuhn, Bruno Latour and Alfred N. Whitehead.

In viewing the world one maintains a certain set of rules and standards to be true, and from and through these rules and standards, one formulates problems as well as solutions to phenomena. Thomas S. Kuhn cemented this notion in 1962 with his book *The Structure of Scientific Revolutions.* In this he describes how Science historically has moved through various *paradigms*. Science is for Kuhn any field in which progress on some level can be detected (Kuhn, 1962). Although his book centers around what we know as the natural sciences (physics, chemistry, astronomy), he is very much open to the interpretation that Science is very hard to define, especially in the light of his historical research (Kuhn, 1962). Paradigms as described by Kuhn are systems of prevailing thought within a group of people performing progressive research, which in turn can be called Science. The paradigm governs the group's entire school of thought. The school of thought within the paradigm defines which sort of problems can be raised, and just as important, what kind of solutions can be constructed. Indeed, it is the very notion that when a particular field of progress transcends the conventional school of thought, which Kuhn calls *normal science,* that a shift in paradigm within the science occurs. Kuhn argues that the field undergoing a paradigm shift changes its entire way of thinking:

> *"Scientists adopt new instruments and look in new places. Even more important during revolutions scientists see new and different things when looking with familiar instruments in places they have looked before." (Kuhn, 1962, p. 111)*

The perspective of the science has radically changed as if the community were "*transported to another planet*" (Kuhn, 1962, p. 111). The consequence of the shift is important in that objects which were regarded as one thing before the shift are transformed into something else after the shift. What were ducks once, are now rabbits as Kuhn states (Kuhn, 1962). With this view Kuhn paves the way for a different interpretation of the validity of Science. He is, in effect, asking what the object of Science is, and how we even know that it is Science. If Science and objects within a field can change over time, where does that leave our knowledge and epistemology of the object of Science? Kuhn argues that our knowledge depends on conversion and persuasion of scientists within the field in question (Kuhn, 1962). Those scientists that resist the new school of thought are left on their own and their ideas of thought eventually fade out, as time inevitably thins their numbers. This of course leaves little room for "matters of fact"[3] to have any bearing on the path and acceptability of Science. The correspondence of theories describing "*what is really there*" and "truth" (Kuhn, 1962, p. 170) is tenuous at best, Kuhn claims:

> *"The notion of a match between the ontology of a theory and its "real" counterpart in nature now seems to me illusive in principle." (Kuhn, 1962, p. 206)*

This point opens up for the discussion of what Nature is viewed as and how it is constituted in relation to Science and indeed, to society. This is a point of contention that the French sociologist Bruno Latour tackles and which this paper also deals with together with Kuhn's notion of paradigms.

[3] "Matter of fact" is here adopted for two reasons. The first being the explicit use by Robert Boyle in relation to the outcome of his experiments (Shapin & Schaffer, 1985) and secondly, to draw attention to Latour's notion that matter of fact is more a matter of concern (Latour, 2005, p. 87ff).

Science and Nature

If Kuhn viewed Science as a whole and the progress of individual sciences from a historical bird's eye perspective, Latour very much views Science and the construction of the individual sciences from within and investigates on a very detailed level what goes into making scientific objects. In *Science in Action* Latour shows how a series of actions are constituted into scientific objects effectively making them into *black boxes*. Black boxes are objects that are no longer questioned, examined or explored, but merely used and viewed as input/output devices and objects of reference (Latour, 1987). Latour shows that the construction of facts and scientific objects is dependent upon a researcher's ability to use persuasion to convince fellow scientist and prominent people of influence. In order to do this scientist must e.g. be skilled at operating instruments and interpreting readouts from those instruments and presenting them in a beneficial way in regard to their desired goals. It also involves getting funding to build and operate laboratories and places of research. This is especially an important point if a research team is trying to disprove a claim on a scientific object already made. In order for this to be done, a corresponding arrangement of instruments of the original lab must be constructed (counter-laboratories) in order to prove or disprove the claim - an activity that can be financially cumbersome (Latour, 1987). The procurement and enrollment of allies is also an important feature of this science in the making. Thus, the constant stream of text production in e.g. articles and letters to colleagues etc. play a large role in getting others interested in one's work and subsequently in furthering the process of creating a scientific object.

There are two main implications present in Latour's argumentation of particular importance in regard to this paper. Kuhn hinted at both, but Latour solidifies them without little

chance of misinterpreting them. The first one being, that when approaching and trying to untangle scientific facts and artifacts, one reveals that they have gone through a long process in their making; they have a history of becoming. I.e. they have undergone a science in the making in order to be established as facts.[4] The method by which this process have undergone transformation from actions to object (from verb to noun) is related to a multitude of relationships between people, instruments etc. The first principle in understanding Science as Latour states in *Science in Action* is to understand that *"the construction of facts and machines is a collective process"* (Latour, 1987, p. 29).

The second implication is contingent on the first and has far reaching consequences, which Kuhn also touched upon. If the construction of scientific objects is dependent on a process of negotiation between people, manipulation of technical instruments and enrollment of allies, where does that leave the notion and understanding of Science in relation to Nature?

The transcendental Nature

The consequence of Latour's work points to the fact that Nature does not contain facts that scientist discover through their work. On the contrary, it is because of the many procedures done by scientists that these relations are made out to be a representation of reality. Latour turns the process of fact making upside down as represented by his many Janus-faces in *Science in Action*, each side representing before and after a series of actions have been black boxed and made into a scientific fact or statement.

[4] "Fact" is etymologically derived from the Latin *facere* – to do or to make, suggesting a temporal aspect.

In the sciences every fact and black box represents one more piece of the puzzle in understanding what is really out there or in other words, every fact that is obtained widens the understanding of Nature a little more. Latour disagrees with this notion. In the book *We Have Never Been Modern* and later expanded upon in *Politics of Nature* Latour argues that the dichotomy between Nature and Science and even the separation of politics, economy, culture etc., is a simplistic way of viewing the world. As he showed in *Science in Action,* Science cannot be disassociated from social, political or economic aspects. They are all interconnected in a myriad of ways. As Latour reads the headlines in the newspaper in *We Have Never Been Modern* it is evident that the categories we try to maintain constantly collapse and intertwine with other categories making what he calls *hybrids* (Latour, 1993). Politicians are e.g. engaged in discussions about global warming which in turn is linked to economy etc. Hybrids are a way of understanding the complex relational nature of the world and at the same time a way to expose the rigid understanding of the world. The idea of hybrids makes maintaining absolute categories difficult and at the same time urges one to look at the relationships that make up the hybrid. Indeed much of the project of Latour, as pointed out by Anders Blok and Torben Elgaard Jensen, is very much to redefine the categories of the world which we thought we knew (Blok & Jensen, 2009). In this regard the concept of thinking in hybrids is a first step of exposing and defining those categories. This paper is trailing Latour's path and also seeks to identify hybrids in order to question their origins of categorization.

The conventional view of Nature, Latour claims, has little to do with how we interact with Nature (or how it interacts with us). Our view of Nature is that it is an external category, subject to quantification and domination. Ever since the sixteenth century a progressing

compartmentalization of Nature has taken place (Westfall, 1992). Science has increasingly been put in charge of defining what Nature is, where we should encounter it and how we should deal with it. Nature is perceived through experts, who tell us what to look for and why (Latour, 2004). Like Plato's philosopher governing the State by right of having access to the idea of Good; in a similar way is the modern day scientist able to shift back and forth between society and Nature and tell the rest of society what he has discovered out there in Nature. He can thus tell us of DNA strings, sub-atomic particles, or the existence of a super-ego in the human mind and with this knowledge in hand he can proceed to manipulate Nature as he sees fit.

Again Latour objects with the notion that, as shown, Nature is not an external sphere of objects but an integral part of reality. The scientist cannot manipulate Nature without also manipulating himself and everything which denotes being human. The definition of human existence is ingrained in the concept of Nature. Human existence cannot be understood by looking at humans alone:

> *"What would a human be without plants, lions, cereals, oceans, ozone or plankton? A human alone, much more alone than Robinson Crusoe on his island. Less than human. Certainly not a human." (Latour, 1998, p. 230)*

Latour here also mirrors the ideas of ANT (actor-network theory) developed with Michel Callon and John law in the 1980's and epitomized in articles such as Callon's *Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of St. Brieuc Bay*. The underlying theme shared by ANT is that non-human actors as well as human actors are relationally intertwined and not considering all of these different actors one is missing important aspects of an analysis. Latour reaffirms this notion in *Reassembling the Social*

reiterating that *the Social* is not only made up of humans and their interactions but of non-humans, concepts etc.

The real force of the political-ecology movement Latour suggests is the exposure and unveiling of the many non-human actors that are also involved in issues regarding climate issues. These should consequently also be considered and factored into the discussion of these issues (Blok & Jensen, 2009). This notion, as we shall see, is paralleled by the organic movement which also highlights and problematizes issues with regard to both non-human and humans in relation to food.

The processing of objects

Unveiling and exposing hybrids is only one part of the puzzle for Latour. The much greater and much more important aspect is the relationship analysis. As objects are black boxed by a series of actions, those actions can be un-black boxed as shown by Latour in e.g. *Science in Action*. Kuhn showed that objects that were once perceived as something in one paradigm could be perceived as being something else entirely in a subsequent paradigm as in the case of the sun, moon and other celestial objects before and after Copernicus (Kuhn, 1962, p. 200). Objects then are not entirely stable phenomenona, but change over time. This is exactly what Latour is interested in examining. Not so much the object itself, but the change the object undergoes and why. It is the network (relationships) and not only the nodes (objects) that are of interest in actor-network theory.

Latour's underlying concept of process is a vital component in understanding much of how we can view the world. If everything in the world is viewed as a process the focus shifts

from viewing individual objects, to viewing their act of becoming into other objects. In other words the being/becoming metaphor suddenly becomes very essential and predominant. One is forced to consider the temporal aspect of all things in conjunction with the apparent stabile objects. The interests of people and the traces of those interests thus become the focus point in e.g. ANT in the term *translation*. It is as much the nodes (network/actor) as their becoming that is important when establishing what society is made of. Society is made of concrete things to be sure, but their interactions in continual processes are what constitute and describe society.

Understanding the underlying premise of Latour's thought helps understand the need to dissolve the categories of Nature, Politics, and Science etc. These simply do not exist other than in headlines and book sections. They are an illusion and a very difficult illusion to maintain for very long. They are under constant transformation and undergoing a continual process of becoming by a tangled web of actors each engaged in a process of their own, which in turn, is also undergoing a process by actors and so forth. Viewed in this way we can understand why Latour insists on breaking down the notion of viewing the world in categories, objects or units. The world should be viewed temporally as well as materially. The notion of processual thought is often attributed to Alfred N. Whitehead, who Latour also cites regularly. It is to Whitehead the paper turns to next in order to understand how to include temporality into the worldview of materiality.

Processual thought

The idea of thinking in processes and conceiving objects as entities moving through a temporal dimension can be dated back to the Greek philosopher Heraclitus who professed how one

cannot step into the same river twice (Browning, 1965). However, this idea has not been the prevalent school of thought in western philosophy as Whitehead points out in his statement that all western philosophy is a footnote to Plato.[5] With this he is, in part, referring to the dualist world perspective presented by Plato in the form of perfect ideas floating in an unreachable realm (for mortals) and their imperfect counterparts being represented in the physical world as phenomena. The relationship between the perfect forms of ideas and the physical phenomena were never fully made clear except it was possible through philosophy to gain insight into the nature of the perfect ideas. Descartes maintained this notion of duality with his notion of mind and matter, but with the same difficulties in explaining how the interaction could take place between the two.

Whitehead seeks to go beyond this dualistic view of the world. In essence, his philosophy is a philosophy of event ontology in contrast to substance ontology. An event ontology sees the world as always being in motion and what we perceive as things (reality) a merely flashes or "*actual occasions*" of a stream of processes (Whitehead, 1978, p. 211). No object teleports into existence, as if ex nihilo, without a history of becoming (Whitehead, 1978). The act of becoming is in this view a more fundamental attribute of reality than the substance of being.

Alfred Northhead living at the turn of the twentieth century (1861-1947) was well aware of Einstein's theory of relativity and later the development of quantum mechanics, both of which Whitehead tried to incorporate into his philosophy. His idea of space being inseparable from time thus paralleled Einstein's notion of space-time. The concept of space-time is that

[5] "*The safest general characterization of the European philosophical tradition is that it consists of a series of footnotes to Plato."* (Whitehead, Process and Reality, 1978, p. 39)

space and time are both relative objects dependent on the viewer's perspective, and more importantly that space cannot be separated from the dimension of time. In an attempt to gain greater understanding of how the field of quantum mechanics (and physics in general) can shed light on our understanding of reality and vice versa, quite a few interdisciplinary publications have a been made in recent years expressly targeting the metaphysics of Whitehead.[6] *Physics and Whitehead* sums up time, according to Whitehead, in a fashion that correlates with that of Einstein's:

> *"Time is not an incidental aspect of reality added on to fundamentally static things; instead temporal change is a fundamental feature of the physical world" (Clayton, 2003, p. 6)*[7]

The basic unit of the universe is an event and we perceive the world by focusing on individual events within the endless stream of processes (Whitehead, 1978). These events which are frozen momentarily by us are then perceived as objects. Objects are thus temporally linked to other occurrences of the object: *"It is atomism without isolation: nothing exists as an island unto itself"* (Clayton, 2003, p. 8). The shift from solid objects in classical physics, to clocks and events in relativity and to "no objects" (Eastman, 2003, p. 22) in quantum mechanics further alludes to viewing the world differently than merely of substance alone.[8]

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[6] E.g. *Physics and Whitehead (*2003*)* and *Quantum Mechanics and the Philosophy of Whitehead (*2004*).*

[7] It should be noted that the Latour's concept of time is slightly different but also adheres to the notion of time being relative in contrast to being absolute. See (Harman, 2009, p. 30)

[8] I am aware of the irony of invoking science in the form of physics as proof of argument in a paper written within the field of STS. *Physics and Whitehead* have no qualms with this however. In its defense it should be noted that the entire project of the book is to synthesize "matters of fact" with matters of philosophy. The question of processes (and belief!) is based on the following matter of fact: "*Matter, such as a table or a chair, seems so solid to us, but this is a limitation of our senses. In fact, so-called solid matter is just emptiness, except for a dance of virtual particles. The mass in matter occupies an extremely miniscule volume. Since we are now more familiar with the constitution of matter, we are in a position to understand just how incredibly empty matter really is. First, electrons have very little atomic mass and are points to the limit of our measurements. Second, more than 99.9% of*

The consequence of viewing the world as events and processes is evident then. The focus of attention in describing the world is not to be put on substance alone, but how the substance is formed and comes into existence. Turning to physics again, this is exactly what the science of physics aims to do. The concept of physics is to show the processes of nature.[9] Indeed the greatest unsolved mysteries of physics deal with just this issue, of understanding the process by which objects and particles relate to one another.[10] It is the relationship between various particles that are of most interest (how they come about, what they do next etc.) and not the individual instances that are of interest. With Latour in mind, this comes very close to how we should analyze the world in his theory of translation (ANT). Here is how *Physics and Whitehead* sums up Whitehead's relational approach, at the same time bordering a definition of ANT:

> *"Objects should not be taken in isolation, defined on their own, and then considered in their relations to other objects. Instead, relations are primary, and objects are defined in terms of the network of relations of which they are part–relations between other parts of the physical world, between other temporal instances present and past, and perhaps between nonphysical moments as well." (Eastman, 2003, p. 27)*

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the atomic mass is in its nucleus. […]Matter is really empty space to an astonishing degree. However, the "empty" atom is filled with virtual pairs and also with photon and gluon force carriers that are continually being birthed and dying—a dynamic, creative process at the most elementary level of matter." (Jungerman, 2003, p. 53)

[9] As Whitehead puts it: "*It is the purpose of science to trace the laws which govern the appearance of objects in the various events in which they are found to be situated."* (Whitehead, 1959, p. 169)

[10] Gravity e.g. has never been fully explained other than its relationship to mass. No particle other than the (yet) hypothetical *graviton* has been identified as being the cause of gravitation, i.e. the mediating actor that interacts with objects. The dark matter of the universe is another example of a suggestion to an explanation why the universe is expanding and indeed an attempt to explain the mass of the universe, i.e. as the mediator to the ever increasing expansion. See (Hawking, 1993) for further elaboration on dark matter.

Being and becoming are inextricably linked. Both in physics and in society, as Latour has demonstrated. People define themselves; can only define themselves, by referring to something else in relation to them. In this regard it mirrors what physics are trying to do. How else would one define oneself other than referring to the place where one works, what the name is of one's spouse and kids or where one has gone to school? The identities of people are linked to the past, present and future and are as such a process rather than an immutable object.[11]

Whitehead's process philosophy, as it has been come to be known, is at its heart a philosophy of metaphysics, i.e. it offers a certain perspective on how we should view the world around us. What it consists of and what it is. From a metaphysical point of view we can derive an epistemological, ontological and ethical perspective of the world.[12] This is exactly also much of what Latour's project has been aimed at. By showing that the world is at its heart a process and demonstrating what the consequences are when viewed in this way. Latour himself has stated on occasion that he is really more interested in metaphysics than sociology and with good reason as society or the Social is made up of processes and relations (Harman, 2009).

The paper now turns to the field of food. The first section describes how food has been made scientific and subsequently been treated as a mechanistic object that can easily be manipulated. The second section examines the reaction to this view in the form of the organic food movement which originally objected to treating Nature as a knowable and manipulative object.

[11] I chose not to go deeper into the identity of the self in fear of trespassing on the field of psychology.
[12] Rand provides a thorough examination of how metaphysics is linked to epistemology, ontology, ethics and aesthetics. (Rand, 1984)

Food metaphors

As mentioned in the introduction, approaching the field of food is a daunting task and one has to be very careful to avoid the many pitfalls that might easily move one's focus from the area of attention. This paper's viewpoint is very broad indeed, viewing food from a bird's eye perspective. The advantage of this approach lies in the ability to uncover underlying problematic systemic issues within the field and subsequently identify suggestions as to how to solve those problems. The downside to the approach is of course that it will undoubtedly miss details and more fine grained discussions of individual issues concerning food. When appropriate the paper gives references to where matters of particular interest of detailed problematic issues can be located.

Demarcating food in a particular way received its inspiration from Michael Pollan's book *The Omnivores Dilemma.* Pollan investigates food production, distribution and consumption by following what he perceives as being the three major food chains in modern society: The industrial food chain, the organic food chain and the hunter/gatherer food chain (Pollan, 2006).

This paper maintains Pollan's demarcation, but only to a certain extent as it examines what lies behind the construction of these food chains. In this respect it examines the infrastructure of the food system and new metaphors for viewing food have as a consequence been necessary to maintain focus. The first metaphor is seeing food as a mechanical object.[13]

[13] This way of systematically thinking about systems as metaphors also owes much to Gareth Morgan's *Images of Organization (2006)*

The mechanics of food

The seventeenth century gave rise to modern Science with e.g. Francis Bacon systematizing the object and methodology of Science in e.g. his work from 1620 *Novum Organum* and with Robert Boyle furthering the notion of meticulously systematizing and detailing series of actions into experiments (Shapin & Schaffer, 1985). René Descartes writing on the continent, mainly in Holland, to prevent religious prosecution, as had befallen Galileo Galilei in 1615, published in 1637 his *Discourse on the Method* and in 1641 *Meditations on First Philosophy*. Descartes is often attributed to the conceptualization of viewing the world as a machine (Russel, 1945). In particular viewing humans and animals as simple input/output devices that are subject to be manipulated by external stimuli. Inherent in this belief is that the machine is knowable in absolute detail. Indeed the world, in Descartes' perspective, could be broken up in ever increasing detail:

> *"But quite the opposite holds in corporeal or extended things; for I cannot imagine any one of them how small [soever it may be], which I cannot easily sunder in thought, and which, therefore, I do not know to be divisible." (Descartes, Meditation Six, 1901)*

Natural philosophy, as Science was called in the seventeenth century up until the mid-nineteenth century, had as the name implies, Nature as the object of study, just as the natural sciences proclaim to have today. Nature was thus an external sphere to be investigated, categorized and ultimately, in Bacon's perception, to be dominated (Russel, 1945). The mechanized perception of nature reached new heights with Pierre-Simon Laplace in 1814 proposing that given absolute knowledge of the cosmos, i.e. location and momentum of every

object, one would be able to predict the future as well as describe with certainty all previous events (Russel, 1945).

This very brief introduction will suffice in creating the preamble to the scientification of food.

Food becoming a science

In 1827 the chemist and physician William Prout proposed the three main constituents of food to be sugars, oily bodies, and albumen which would later be known as carbohydrates, fats, and proteins. The three macronutrients, as they are called, are often found on today's food labels describing the contents and percentage of each nutrient of a given product. With nutritional content contributions from German chemist Justus Von Liebig (more on him later) and together with findings in 1912 by Polish chemist Kazimierz Funk proposing the concept that would come to be known as vitamins[14], part of what is now called micronutrients, the mysteries of food contents was well on the way to be revealed. Food had been driven into a corner and "*forced to yield its chemical secrets*" as Pollan denotes (Pollan, 2008, p. 21).

Justus Von Liebig plays a critical role in both the modern industrial food complex as well as in the organic food movement. In 1840 with the book *Chemistry in Its Application to Agriculture* he proclaimed to have identified the three main chemical elements that plants require to grow. The trinity of chemical components were nitrogen (N), phosphorus (P), and potassium (K), the most important of the three being nitrogen.[15] Just as the three components

[14] The Scottish physician James Lind had by 1747 successfully treated sailors suffering from scurvy with citrus fruits thus indicating a particular unknown attribute of the fruits involved. This compound was later proposed as being labeled vitamin-C (1920).
[15] The letters denoting their chemical designation.

of food have changed very little from their conception, in similar way has the NPK trinity lived on to the present and is found in all modern fertilizers ranging from industrial fertilizers to household plant fertilizers and NPK is found on the labels on most of these products. The trust in and consequences of NPK would also light the fuse of the origin of the organic movement with Sir Albert Howard's attacks on the "*NPK mentality*" (Pollan, 2006, p. 146).

The identification and subdivision of the chemical compounds which plants required to grow, paved the way for synthesizing the chemical contents of this mixture. Up until 1909, with the perfection of the Haber–Bosch process by German chemical company BASF in 1913, fertilization of earth was primarily done by biological material in the form of organic plant matter and manure from livestock. The Haber-Bosch method would result in a profound and fundamental shift in food production and create a dependency on synthetic fertilizers that remains to this day. The Haber-Bosch method (also known as artificial nitrogen fixation) made it possible to synthesize the process in nature by which nitrogen molecules in the air are fixed to hydrogen molecules forming ammonia (NH_3). 78% of the air around us consists of nitrogen and is a vital component of living organisms.[16] The story of the Haber-Bosch method is an interesting story unto itself because the end product (ammonia) is also a key component in explosives; World War I starting one year after BASF perfected the process. Fritz Haber, the German scientist, who is attributed to the original development of the process for which he was rewarded the Nobel Prize, would also play a role in the development of poisons gasses deployed in World War I and his research on the Zyklon B gas used in concentration camps during World War II.

[16] The previous mentioned vitamins were named after "vital" for life and "amines" denoting the nitrogen compound. Vitamin is another words a nitrogen molecule flanked by other molecules.

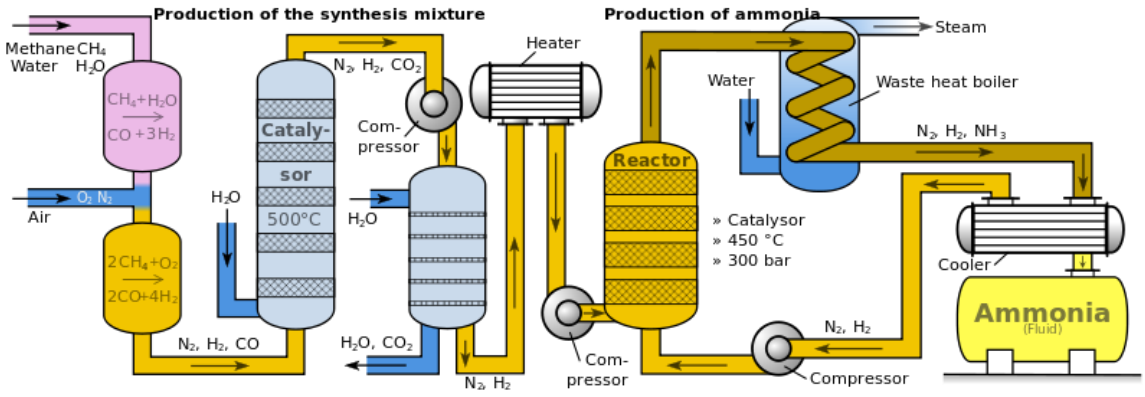

Figure 1 Synthetic nitrogen fixation using the Haber-Bosch process.[17]

The nitrogen fixation process which leads to synthetic fertilizers was one of the many innovations not foreseen by Robert Malthus in his *An Essay on the Principle of Population* and which gave economics the reputation of being the dismal science. Although the exact estimates are disagreed upon, the rough estimation is that the 100 million tons of synthetic fertilizers produced each year are responsible for sustaining one third (1/3) of the earth's population (Hager, 2008) (Pollan, 2006).

The pests of chemical fertilizers

As the Second World War winded down the factories that had produced chemicals, e.g. ammonia for use in munitions shifted their production to synthetic fertilizers flooding the market creating cheap and abundant fertilizers (A.Duram, 2010). It is in the period following the Second World War that farming, especially in the USA, became large scale operations with the use of mechanized tools, as a result of machinery plants from the war also shifting their productions lines to agricultural equipment. This caused the consolidation of smaller farms into larger due to increased productivity offered by the machines.

[17] (Wikimedia Commons)

Without the need to perform constant crop rotation or plant cover crops to increase soil fertility, as was required before the heavy use of synthetic fertilizers, farms became increasingly monocultural, i.e. reliant on planting just one or two crops. As a result, pest control was needed to cull an ever-increasing emergence of various perceived pests that in the past had been regulated due to natural biodiversity in polyculture farming. Pest control is not a new phenomenon, the Romans e.g. used salt to keep unwanted weed in check, burned sulphur to kill insects and arsenic compounds have been used throughout farming history, e.g. when coupled with honey to kill ants (A.Duram, 2010). In a pure monoculture however the perceived pests will usually increase in severity due to the abundance of feeding material the perceived pests prey upon. I.e. an ever increasing abundance and presence of corn will also increase the number and variety of animals, plants and fungi that feed of the plant. Perceived pests are usually divided into four main categories, as shown below, with the correspondent poison designation to kill them:

- Plants (herbicide)
- Larger animals (rodenticide)
- Fungi (fungicide)
- Insects (insecticide)

The paradoxical notion that the application of increasing amounts of fertilizer to crop to increase yields will also force the need to use pesticides in greater intensity is what Rachel Carson attributes to *"nature fighting back"* (Carson, 1962, p. 245).[18] With *Silent Spring* Carson

[18] Research also documents that crops that have received heavy supplies of NKP are "*preferentially attacked by aphids, while plants manured organically are less or not at all affected by aphids because of the lower water contents and thicker cell walls of the plants"* (Heaton, 2001, p. 11).

forcefully highlighted the dangers of pesticides or *"biocides"* (Carson, 1962, p. 8) as she named them indicating their indiscriminate nature in killing all living things, including large animals, such as beavers and birds, and influencing human physiology to even deadly degrees. Carson touched upon several important issues that the modern food system continues to struggle with. She noted the previous escalation of pesticide was needed when farming in monocultures, but also caused by increased resistance in the organisms targeted by the pesticides. Superbugs were already beginning to appear in the 1960's and flies covered with the white deadly substance DDT (Dichlorodiphenyltrichloroethane) were observed to suffer no ill effects from it (Carson, 1962).[19] These were organisms that had through natural selection acquired resistance and even immunity to high doses of pesticide. The consequence is the ever-increasing administering of even more toxic poisons to cull the perceived threats and at the same time wrecking far reaching collateral havoc, impacting biodiversity in streams, forests and even in cities (Carson, 1962). Carson never saw the full impact of her seminal work. She has subsequently been noted to be the chief source of the upsurge of the environmental movement and a cause for the formation of the EPA (Environmental Protection Agency) in the USA in 1970 and furthermore impacting the banning of many chemicals including the aforementioned DDT.

The use of pesticides would come to form the main argument against the modern industrial food system because of health concerns, in the opinion of the pro-organic consumer (Zanoli, Bähr, Laberenz, Naspetti, & Thelen, 2004).

[19] The story of DDT is as in the case of the Haber-Bosch method a story on to itself that is still ongoing. It was heavily used during WWII to combat malaria and was since used intensively as an agricultural pesticide being spayed from planes over large areas or administered more locally. It is still used to combat malaria in e.g. sub-Sahara and is still a matter of contention as DDT is still very effective at killing mosquitos, consequently saving countless number of lives. For detailed rundown of the issue see (Gladwell, 2001).

Pesticides are ubiquitous in use in the modern industrial food system. In 2008 the global pesticide market was estimated to be 58 billion dollars and expected to increase steadily (A.Duram, 2010). DNA recombinant crops, such as Monsanto's roundup ready soybean variant, a genetically engineered crop to be resistant to specific types of herbicides and even producing toxins to certain pests, have decreased the need for excessive pesticide spraying in some areas, but have introduced new problems such as superweeds. These are new strains of plants that require very toxic chemicals to kill and are only made possible because of the introduction of genetically engineered crops that are subsequently cross-breeding with wild relatives (A.Duram, 2010).

Transformation of food into nutrients

The last major epicenter of the mechanization of food takes us to Prout´s identification of carbohydrates, protein and fats and Funk's vitamins some years later. The constant search for more nutrients has led to what is now known as functional food[20] or in the words of Professor of food studies at New York University, Marion Nestle, *"technofood"* (Nestle, 2003, p. 273). Functional food is defined by Nestle as:

> *"Foods enriched or fortified with vitamins, minerals, protein, fiber, amino acids, or fatty acids, as well as herbs, plant phytochemicals, and even wood pulp derivatives. They also include "lesser evil" foods that have been formulated to be low in calories, fat, sugar, salt, caffeine, or allergens or to contain artificial substitutes." (Nestle, 2003, p. 296)*

[20] Also known as designer food or nutraceuticals, enriched food etc. depending on the source.

The act of fortifying, enhancing food in some way is not entirely new. The most notable example is of the common household salt that, starting in the 1830's in the USA, has had iodine added to prevent goiter. Other examples include the fluoridation of water to prevent tooth decay.[21,22]

Enhancing food is the main consequence of two aspects of the modern food system. The first is because processing food makes it lose much of food's nutritional content, added nutrients are regarded as necessary to compensate for that loss. The act of milling wheat e.g. will decrease vitamins and mineral levels of up to 25% compared to the whole grain of wheat (Nestle, 2003). The second reason of which the first is becoming ever more contingent upon is the increased knowledge of food contents – the nutrients. The aforementioned macronutrients of carbohydrates, fats and protein and the micronutrients of vitamins only marked the beginning for what has become a massive industry of food science. The field of food technology being its applicable branch making strange new Frankensteinian nutritional objects that cannot be categorized by any normal inference to any of the three kingdoms of living organisms: plants, animals or fungi and cannot be found anywhere outside the supermarket.[23]

One of the apogees of the rise of nutritionism (Scrinis, 2008) is the development of olestra. Olestra, researched by Proctor & Gamble, is a fat substitute meant to replace the fat contents of any product. The unique properties of olestra make the compound unable to be digested and products containing olestra are therefore marketed as having no calories or low in

[21] According to the CDC in the USA (Center for Disease Control) decreasing tooth decay with as much as 60% by this process. See note 34 in (Nestle, 2003, p. 430)
[22] Adding iodine to salt is e.g. mandated by law in my country of origin (Denmark).
[23] Pollan in this vein asks how a chicken McNugget should be categorized considering that approx. 40% of contents is made of corn (Pollan, 2006). Similarly the question could be raised regarding tube cheeses, power bars and protein rich soft drinks, Twinkies, many cereal products etc.

calories. The molecules of olestra are simply too big to be absorbed by the human digestive tract and thus simply pass through the body. The ethical, economic and environmental issues concerning the production and manufacturing of olestra are mind-bending considering that it is a marketed as a food constituent with no nutritional value with its purpose being to make people feel better about eating the product and of course increasing sales of the product.[24]

Behind nutritionism is the belief that food contents can meticulously be broken down into parts and their biochemical composition be fully known and synthesized. However, the notion of complete information being an illusion has long been known within other fields such as economics and the natural sciences with e.g. Karl Popper noting that all theories are subject to be falsified, in effect suggesting that we do not at any one time retain correct and absolute information of any one given field (Popper, 1959).

Following the mechanistic view, food has become the sum of the parts that can be identified as nutrients. In identifying nutrients, these can be substituted, added and removed to create a somewhat different instance of the food found outside the supermarket. Food in the nutritionism perspective is found more on the label of the food than in the food itself of which it is a mere sample representation of how the nutritional contents can be realized.[25] Nutritionism has moved our concept of food along an entirely different path. The carbohydrates, fats, proteins, vitamins and mineral contents of food have become more important than looking at the actual food and deciding if this is something we wish to eat. The cheese with the high fat contents is discarded in favor of low fat cheese; the milk with the

[24] See (Nestle, 2003, p. 338ff) for the complete story of olestra.
[25] The platonic idea of the perfect abstractions and their worldly counterparts seems to have found new meaning within the field of nutritionism.

added vitamins is preferred over milk without any added nutrients etc. We turn to labels on the food to get a description of the food instead of looking at the food. The project of finding out what our food consists of is often a job more for the scientist and investigative journalist than lay people, Pollan denotes (Pollan, 2006).

In the next section the paper examines the reaction to the mechanistic view in form of the organic movement and sees why the movement may not have been successful in breaking away from food understood as a machine.

Food as an organism

The second metaphor for food mirrors the main arguments of the proponents of the organic movements. The first being Sir Albert Howard (1873-1947), an English botanist, who had spent prodigious amounts of time in India and learned the art of composting and subsequently developed theories concerning soil fertility and soil balance. He railed against the prevalent NKP mentality left behind by the findings of Justus Von Liebig (Pollan, 2006). Soil health, Howard argued, is intricately linked to human health and thinking that soil fertility could be understood by chemical composition alone *"is superficial and fundamentally unsound"* (Fromartz, 2006, p. 9).

The notion of soil fertility and indeed the relationship to the earth was paralleled and further developed in e.g. in Germany with Rudolph Steiner's biodynamic agriculture promoting the view that farms should be treated as organisms that could sustain themselves without external stimuli. Lady Eve Balfour in England, cofounder of the Soil Association[26] released *Living*

[26] Soil Association is the UK's leading organic organization, see http://www.soilassociation.org

Soil in 1943 documenting the effects of agriculture based on chemical versus non-chemical use. Jerome Irving Rodale in the USA formed the Rodale institute and published the magazine *Organic Farming and Gardening*[27]. *"Healthy soil, healthy food, healthy people"*[28], which has become the motto for the Rodale institute indicating the strong focus on soil and earth being the primary primordial components of food.

Today organic food has diverted in many directions other than the ones above. It has become a counter-movement touching on all areas of the modern industrial food complex. If one seeks to define organic food one can simply look at the legislation allowing producers labeling their products as organic.[29]

Figure 2 The EU and US symbols for organic products.[30]

But the perception of organic food transcends, for many people, these agreed standards of labeling as the standards fail to incorporate all of the issues raised by the original movement that viewed the act of food production as an organism sustaining itself. The reactions to the modern food complex by the organic movement fall within four main categories as shown below with examples of detailed issues:

[27] Now known as *Organic Gardening Magazine*
[28] See http://www.rodaleinstitute.org
[29] In the USA the legislation for organic standards was completed in 2002. In EU this happened in 1991. See http://www.epa.gov/agriculture/torg.html#National%20Organic%20Standards http://ec.europa.eu/agriculture/organic/eu-policy/legislation_en respectively for specifics.
[30] Pictures taken from the websites describing the standards see note 29.

- **Matters concerning human health**
    - Use of pesticides is dangerous to human health.
    - Excessive use of fertilizers pollutes ground water and lowers plants ability to develop resistance to perceived pests.
    - Organic food may be healthier, e.g. rich in vitamins.
    - Industrial food contains many synthetic compounds with unknown effects, especially when combined.
- **Matters of ecological importance**
    - Pesticide use indiscriminately kills trees, plants and animals.
    - Fertilizer use creates problem in e.g. lakes and rivers (deoxygenation).
    - Monocultures cause excessive soil erosion.
    - Bio-diversity killed because of monocultures.
    - Pollution from fossil fuels fueling the production of synthetic fertilizers and pesticides are contributing to global warming.
    - The distribution of food, (food miles) also relies on petrochemicals and other non-renewable resources, also adding to global warming.
    - The industrial food complex disrupts natural habitats and creates disorder within the natural food chains.
    - The industrial food complex is not sustainable because of its reliance on petrochemicals.
    - Long term effects of genetically modified organism (GMOs) are unknown.

- **Matters of ethical concern**
    - Animals in the industrial food complex are not treated well.
    - Farm workers in developing countries producing for industrialized countries are being exploited.
    - Exportation of the modern food complex is the newest form of imperialism imposing unhealthy diets on developing counties snuffing out cultural cuisine and understanding of food.
    - Oppression and domination of nature for profit is seen as unethical.
- **Economics of food production**
    - Real price of food is much higher when factoring in e.g. ecological damage caused by the industrial food system.
    - Industrial farming is heavily subsidized in western countries (e.g. corn in USA) creating the illusion of cheap food and further misaligning trade opportunities for developing countries.

Some of these issues will be tackled more in detail later in the discussion of the processes of Nature. The list is by far not exhaustive of the many issues that the organic movement has successfully highlighted in their reaction to the industrial food complex. Common to most of the issues however is the notion of viewing food production holistically, i.e. as an organism of which the individual parts cannot easily be discerned and analyzed and their relations to each other cannot be scrutinized and synthesized.

The reductionism of the romance of Nature

There is also a romantic notion of Nature in many of the pro-organic arguments, which is rhetorically reminiscent of the longing of Jean Jacques Rousseau's pre-social society where Nature belonged to everyone and provided for everyone. Indeed, much of the organic movement maintains the view of treating the food system as an organism that has a preordained cycle: The origin and the culmination of all food is the earth. Concepts such as the fundamental *"Rule of Return"* (Conford, 2001, p. 17) within the organic movement and *"Back to the Land"* (A.Duram, 2010, p. 153) indicate the indulgence of the notion of a more primordial origin of all things organic. Nature as the transcendental domain to which we all must aspire to is central in the perception of food within the organic movement. In this respect the organic movement shares the same philosophical legacy as the mechanistic world view. In the mechanistic perspective Nature is a separate entity which we can decipher and break down into molecules and atoms. In the organic viewpoint, the world is an organism and Nature too is an entity separate from people which people put themselves in relation to and of which cannot be obtained complete understanding, but must instead be sought to be emulated. *The modern constitution* (Latour, 1993) is as such still maintained in both metaphors of food. Both of the metaphors share the same traits in their bifurcation of Society and Nature: The secrets of food revealed by Liebig and the synthetic nitrogen production in form of ammonia as represented by the Haber-Bosch process (figure 1) on the one hand. There is on the other hand the intricate unknowable working of Nature to which we are merely spectators and must follow its cycle of life.

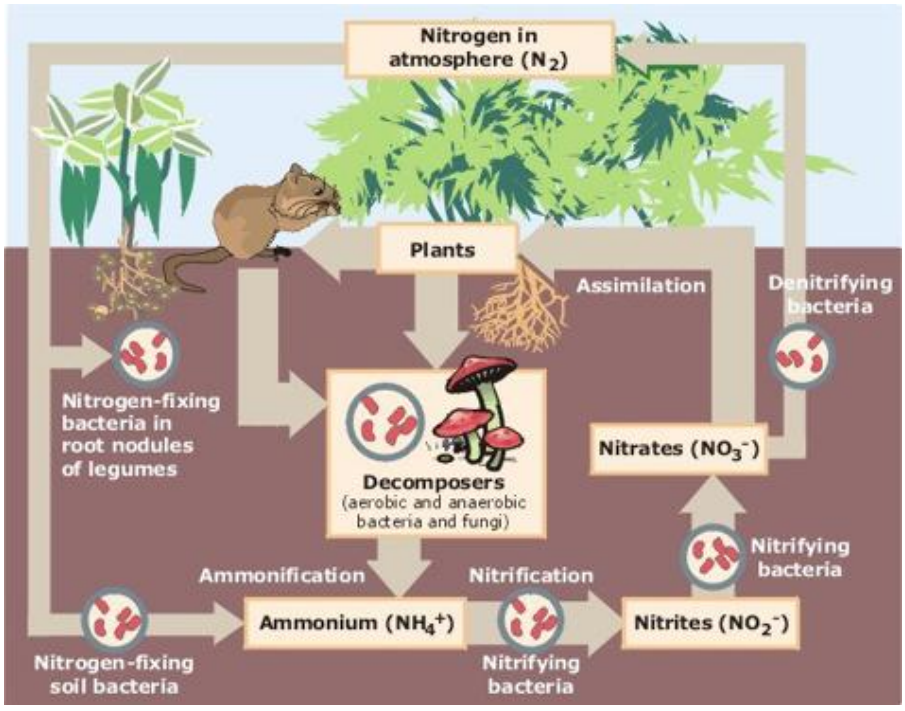

Figure 3 Biological nitrogen fixation.[31]

In the first mechanic metaphor, people, Science and their machines are prevalent and e.g. soil nutrient generation in form of ammonia (figure 1) is entirely mechanical and devoid of any reference to the object of ammonia, i.e. fields and soil. The second metaphor reverses the picture and demotes, and in some sense, disregards the impact, and indeed, the voice of what is not considered part of the natural cycle. Both of the metaphors are in the words of Latour not really describing what is actually going on, but are merely perpetuating the age-old schisms demarcating Nature from Society (Latour, 2004).

It is for this reason a new metaphor, a redefinition (or de-definition), of food must be employed. The next section will explore how a new metaphor can be deployed and successfully address the many issues raised by the organic food movement.

[31] (Wikimedia Commons)

Processing nature

The many issues that the organic movement has raised since its beginning are not trivial and should not go ignored. A new metaphor must successfully attempt to address many of the main points concerning health, ecology, ethics and economics. It must also recognize the efficiency of the modern industrial food machine to provide food in abundance to every corner of the globe.

Attempts, such as the theoretical framework of *foodscapes* that have arisen in recent years[32], have tried to encapsulate the many problems related to food that a steady stream of research in this area produces, including research showing that:

- Obesity is an increasing problem with many correlatives diseases. An estimate puts the obesity level at 60% of the population in the UK by 2050 (Burgoine, Lake, Stamp, Alvanides, Mathers, & Adamson, 2009).
- Obesity is just one of many of the western disease that include a host of afflictions including breast cancer, prostate cancer, coronary heart disease, allergies and colon cancer. The common link to these diseases seems to be the Western diet. (Taubes, 2010)
- The industrial food complex, including the industrial organic food manufacturing and distribution system is very dependent on fossil fuels. About ten calories worth of energy go into producing one calorie of food for humans and the ratio is even higher in some organic production methods reaching a ratio of 57 to 1. This is due to increased tilling of soil etc. (Pollan, 2006). Production of fertilizers, pesticides, fuel for farming

[32] Foodscapes are defined as *"the multiplicity of sites where food is displayed for purchase and where it may be consumed". A. Winson quoted in* (Panelli & Tipa, 2009, p. 3)

and food production and fuel for the distribution of foods are all heavily dependent on fossil fuels that increase global warming. The destruction of forests and swampland in favor of agricultural land or grazing pastures for livestock impacts the amount of CO_2 that is bound to the earth, further increasing CO_2 levels and global warming.

- Sustainability of an increasing population worldwide (the earth's carrying capacity) also complicates matters in relation to going full-scale organic as evidence of produce yields in industrial farming versus organic farming is not unanimously in favor of organic farming. The ghost of Malthus in relation to food security still lingers in this respect (Heaton, 2001).
- The exportation of the Western diet to developing countries presents two main problems: The first being the exportation of what might be an unhealthy diet vis-à-vis the western diseases. The second being, as earlier hinted at, a new form of imperialism of companies making farmers and indeed the general population of developing countries dependent on cheap food and in some cases cheap seeds that have been genetically engineered by companies such as the Monsanto Corporation and can only be bought from them. But it is also as Latour states in *War of the Worlds* the whole scale exportation of the Western system of viewing Science. In our case, the system of how to view food as mechanical, atomistic objects of which the parts are more important than the whole.

Many more issues have been highlighted with respect to food. Food is a complex issue and there is unlikely to be found a magic bullet to solve all the problems, although nutritionism tries

to solve a lot in their pursuit of the modern "soylent green",[33] the magic nutritional pill that can replace all other energy and nutritional intake. This ignores however a plethora of other issues related to our association to food, as food is, as briefly noted in the introduction, not only a matter of nutrition and energy intake.

In many respects the organic movement, in one of its uncompromising forms known as *beyond organic* comes close to addressing many of the key concerns of modern food production. Polyface farm, which Pollan describes in his book, is such a farm (Pollan, 2006).[34] Although the predominant thought within beyond organic is also concerned with the relationship to the soil, it also acknowledges that getting from the transubstantiation[35] of solar energy to a beef on the table requires a series of processes that, if helped and stewarded by people, can be made much more effective than if left to its own devices. At the same time it is possible to maintain and even increase biodiversity of the land. Beyond organic is not merely about following the prescribed standards set forth by government and regulative institutions but instead follow a set of principles of how to view and regard the interaction of people with nature. Beyond organic has decentralized the many actors in the production and manufacturing of food. Grass, almost to a religious degree in the case of Polyface farm, is the most important actor; not counting the sun. But grass too is merely an actor in the network of people, animals and solar energy for securing food in the present and future.

There is one more aspect of food that beyond organic and organic farming to a lesser degree, have foregrounded, which is the subject of knowledge in food production. Knowledge is

[33] Soylent green was the name of the food rations in the dystopian movie by the same name from 1973 depicting a future of depleted resources, dying oceans and hot climate.
[34] http://www.polyfacefarms.com/
[35] Pollan uses this word in describing the almost religious belief in this process (Pollan, 2006, p. 238)

absolutely vital in organic farming and even more so in beyond organic farming. The composition of soil and compost must be studied. The biology of grass must be known in order to maximize its growth in respect to how much grass can support a given amount of livestock, the so-called “cow days” of a field (Pollan, 2006, p. 191). New adaptable ways of production and of dealing with pests must be explored and used, which involves a deep knowledge of which plants and organisms feed off others plants, what natural poisons are secreted from plants and making use of cover crops and bait crops etc. This specific knowledge must be related to each other and to the people working the land to create optimal farming practice and efficacy with regard to produce. The amount of knowledge required for this kind of farming is a far-cry away from the industrial farming where one-size-fits-all solutions are available with e.g. abundant amounts of synthetic chemical fertilizers and a rich variation in pesticide choice. Even creating a GMO, an entirely new organism is evidently not very problematic as Ronald and Adamchak demonstrate in the book *Tomorrow’s Table* outlining a six-step program for making a GMO:

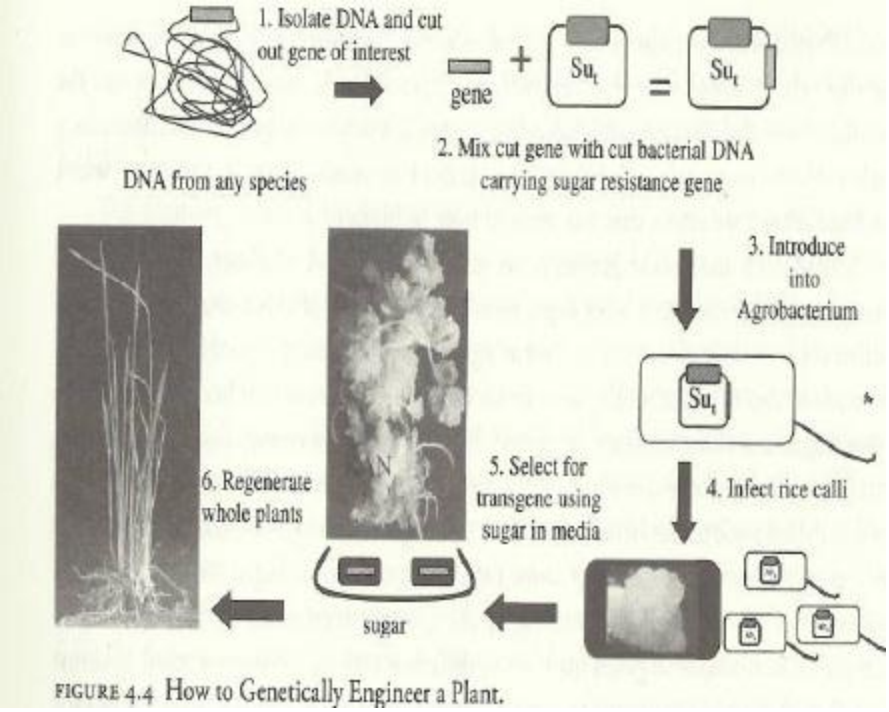

Figure 4 Six step formula for creating a GMO[36]

Creating a genetically engineered organism includes more than just what goes on in the lab however. In creating a new organism other factors are involved including issues that plants of the same species will be outcompeted by the enhanced plant affecting the entire chain that organisms of that plant is reliant upon.

The organic and the beyond organic also have shortcomings however. In particular, beyond organic´s observance of e.g. the energy used to produce and distribute food makes them, on principle, unable to provide food in distant areas because of the many food miles needed to reach distant areas.[37] The knowledge implied in farming organic and beyond organic is profound and takes time to accumulate and assimilate, in effect creating a high barrier to entry. The knowledge and adaptation of that knowledge to local practices is an important point

[36] (Ronald & Adamchak, 2008, p. 49)
[37] Food miles describes how many miles a given food travels from producers to consumer. It is estimated that the average distance a food travels from producer to consumer is 4000 kilometers (A.Duram, 2010).

however. Research indicates that people educated in food are, on average, healthier than uneducated people on the matter (Nestle, 2003). This is attributable to various reason e.g. that educated people of food are generally also well-educated on all matters and are wealthier. In any regard, knowledge of food is just as important for the farmer as it is to the consumer, if nothing else than for answering the question of "where does the tomato come from?" with "from a plant, on a farm" instead of answering "from the supermarket" – which of course is true, in the same sense that Newton can be said to have "discovered" the gravitational force - both of the statements have long series of relational processes behind them, which have lead them to being black boxed.

Eating processes

Untangling the many issues of food is as shown above not an easy task. If a new way of thinking of food, a paradigm, is to be put in place it must try to synthesize many of the important issues that both the industrial food complex and the organic food movement have presented. It must not be overly political, if this is at all possible, if it is to be accepted by the industrial food complex and not rejected by the organic food movement. Objectivity can never be fully obtained[38] and maybe that is not even desired, but then at least we must try to break down the objectivity that is prevalent in the mechanistic view of food with its carbohydrates, fats and proteins.

Every actor in the food complex must be given a voice to make it, not a-political, but then at least more democratic in the sense of equalization. The subtitle of Latour's book *Politics*

[38] See (Haraway, 1991) for the illusion of the "godtrick" or (Latour, 2005) for the fallacy of employing "panoramas"

of Nature is "*How to bring the sciences into democracy*". It is in this vein that food must be brought into democracy. "*A parliament of things"* (Latour, 2004) must be sought to be made of the actors of food production, manufacturing and consumption. All the actors, even the non-human, must be given a voice and if not directly, then by fair representation. The value of the tomato in the supermarket is primarily based on the price tag on the tomato which is derived from the series of processes that all have price tags on them. But tomatoes are not born equal; they are not all the same. Not in "nutritional value" and not in their production method, but the fact that they cost the same gives them the illusion of having the same value. The difference between fact and value (Latour, 2004) must also in some way be shown in the new metaphor for food. To give all the actors of food a voice and to present their fact and values democratically we must follow the individual actors as they move through the process of becoming a food. When we are eating the tomato we are also figuratively eating the process of the tomatoe's becoming. Are we eating a process or are we eating a tomato? The question of the quantum tomato will present the new metaphor for food.

The quantum tomato

Whitehead and Latour have already provided the building blocks and blueprints to the construction of a new metaphor for food. Quantum mechanics, which Whitehead in part tried to build his metaphysics upon, operates among other things with the notion of wave-particle duality. The wave-particle duality covers the concept that all matter exhibits both wave and particle properties, but not at the same time. The quantum state of the matter depends on the act of observation as observing the matter will make it change state (Epperson, 2004). The

tomato from the supermarket or from the garden employs this same duality – the duality of being and becoming. It is obvious that one is not eating a process but instead a red tangible delicious tomato, but the tomato did not arrive ex nihilo. Its creation is based in time and one is in a sense eating all of the tomato's history when taking a bite. This ping-pong between the solid state of the tomato (being/particle) and its process (becoming/wave) is hard to maintain in the mind's eye simultaneously, but they are nevertheless both part of the same tomato. It is easy to ignore the process if one has bought the tomato in the supermarket and one only sees the red substance, but one cannot help to remember the process if one had toiled in one's own garden to produce the very substance. The perspective changes as we are given more information about the tomato just as the quantum state of particles changes when we observe it.

The object then is to represent, to provide knowledge of the tomato in its state of becoming - its process. Knowledge of the becoming of food will enable us to shift perspective from the solid, and go through time, become like an ANT (Latour, 2005) and see the networks and nodes the food has undergone on its way to the table.

Manifestations of processes

In order to change the entire school of thought from the mechanistic view of Nature to a process oriented view a fundamental shift has to occur, not only in the minds of the farmer, the manufactures of food, but also in the mind of consumers. The following is a proposal how to bring this shift to all layers of the food chain, implicitly compelling all links in the chain to acquire knowledge of previous and future links and thereby achieving awareness of the process

of the food they are eating. As with Whitehead, this is not a matter of replacing the being with becoming, but of representing the becoming as well as the being – not if/or but both/and.

On almost all foodstuffs the usual dietary information is displayed in tables indicating the fats, carbohydrates and protein levels as well as maybe mineral and vitamin contents and lately which kind of fats (monounsaturated fats, polyunsaturated fats etc.). It is on the packaging of specifics foods that the paradigm of the mechanistic nature is pronounced. It is here where we all see how much caloric intake was in that chocolate bar we should not have eaten. And it is here where the process of the food must also be represented.

Figure 5 Representations of an oilrig and a truck.[39]

The above figure shows how a practical application of thinking processual could be displayed on food products. The first picture represents an oilrig indicating that the product labeled with this picture has undergone an intensive use of petrochemical production (e.g. pesticide manufacture, synthetic fertilizers etc.). The second indicates that the product has undergone a process of transportation; in this case the product has travelled 2000 kilometers to reach the consumer. Other representations could be thought of including the next two:

[39] From personal collection.

Figure 6 Representations of a flower being picked and a test tube.[40]

Here the first is a flower being picked, indicating a process of people being directly involved in the act of harvesting. The second is that of a test tube and could indicate that the food in question has undergone a substantial manufacturing process involving many chemicals and food alteration processes.

These are of course meant merely as examples of how a process oriented school of thought could be represented on a practical level. To be sure, there are difficulties in deciding which processes to represent and even what series of actions represent a process. Indeed, at first glance the above four representations seem to favor the organic way of growing food, but the organic industrial food complex makes use of the exact same distribution network and to some extent production facilities as the non-organic does (Pollan, 2006). The food miles indicator (the number beneath the truck) would help to represent this fact alone. Is the food miles representation showing what is really going on or is that too a political statement? One thing is certain though, *the full cost of the travel from one connection to the next has not been fully paid* if one only sees the calorie count of the food.[41] In this regard representing the process of food can help to increase knowledge (and curiosity) of the world as it relates to the food. The

[40] From personal collection

[41] The phrase has been modified slightly: "*Has the complete cost of the travel from one connection to the next been fully paid?"* (Latour, 2005, p. 25)

act of reflecting and unfolding the process of the food may go a long way in representing the non-human actors in the parliament of things and even in representing the human actors whose voices have been muffled by the mechanistic paradigm.

The idea that we are making a political statement every time we buy may be true, but on what basis are we making that political statement? The numerous health claims on products which have undergone heavy chemical transformations are bigger and more prevalent than on products that have no added synthetic chemicals, minerals and other additives (Nestle, 2003). How is this instance to be represented? If accepting that processed food is less healthy than non-processed food (Nestle, 2003) one could propose that the fewer representations of processes that are displayed on a given product represent an indicator of health. All products would of course have some amount of processes shown on their label, but simply choosing products that have a low amount of processes on their label has the potential to deal with a great host of issues, including health, ethics, economics and ecology with reverberations throughout all of the processual chain of which the food is a part of.

The processual indicators would serve other purposes in relation to food as well. It would reconnect people with the fundamental food chain that starts with solar energy (and e.g. stored in fossil fuels) which plants use in their photosynthesis binding CO_2 into organic matter, which animals feed upon and which in turn ends up as a steak on our dinner table. For better and for worse, humans are bound to the earth by the fundamental workings of the food chain, but this link to the earth is far from visible where food is found most abundantly – in the supermarket.

Representing the processes of food is not a one-stop solution to all food related issues. It does however giver a clearer perspective of what is really going on (Latour, 2004). Working out the practical implementation of displaying processes on food is a research study in itself with many problems to be worked out ranging from how to graphically (or not) represent processes on foods (e.g. if the food has a small packaging etc.) to ironing out which processes to display in each category. But the practicalities are somewhat secondary to the primary objective which is to enable and drive people to think beyond the three dimensions of the product in hand. Representing processes should not replace selected dietary advice as dietary advice is not bad by default, but should be labeled as only representing a limited snapshot of the food. Seeing that the food is rich with vitamin-c e.g. can help cure scurvy (as demonstrated by Lind) and is an example of dietary advice that is very beneficial. Having both the snapshot data of dietary tables and figures and a collection of representations of processes will give a far more complete picture of the food in question and maybe the only picture that shows why Nature is far less transcendental and more human than we think.

The case of water

This is especially true when we make the most graceful of jabs against the mechanistic paradigm of food in order to determine what it has rendered invisible and how the processual mode of thought can render it visible again. Between 60-70% of the human body consists of water. Water is everywhere in our food, even in dry crackers there is a small amount of water present. Water is essential for not only human life but all life. The metaphor of the primordial soup from which all life sprang alludes to the fact that some form of liquid was present at the

dawn of creation. Indeed many have speculated that existence of water is a key factor at the point of origin of life (Ridley, 1999). Water has many functions in sustaining life. It acts as a conduit and a transport system for other chemicals to traverse the body. It facilitates waste disposal and lubricates many parts of the organic system. Yet, water is rarely mentioned as a nutrient. If one looks at the dietary label of a given product one rarely finds water but instead only the usual suspects of fats, protein and carbohydrates. According to the mechanistic perspective the different kinds of fats, proteins and carbohydrates can be represented by their chemical composition of mainly hydrogen (H), oxygen (O) and carbon (C). Water can also be represented in this fashion by its well-known formula of H_2O. So what gives e.g. protein a more prominent position than that of water as a macronutrient? If the term of nutrients are to be understood as ingredients essential for sustaining life, surely the molecule of water in abundance must be counted among them. Somewhere along the path in increased scientification of food the importance of water has been squelched and taken for granted as a ubiquitous and perpetual resource and indeed ingredient for life.

To be fair, the discussions of an adequate water supply has not been squelched. On the contrary, problems of providing a clean water supply to all areas of the globe is an increasing area of environmental concern. The mechanistic paradigm however does very little to highlight and to address these concerns however. A processual perspective would help make visible the importance of water, for us and our environment. Water is not only essential to us as in the tomato in the salad we are eating. Water is important in growing the tomato, in harvesting and processing the tomato, and even in eating and digesting the tomato. The mechanistic paradigm completely fails in this regard to point to the relationship to water that life holds.

What else does the mechanistic view of looking at food make opaque? If brought out in full force instead of merely jabbing, the processual mode of thought offers a completely new and sometimes opposing view of food than what we are used to in the mechanistic perspective.

Discussion

The perspective of this paper is elevated to a metaphysical questioning of fundamental views on food governing the modern society. The elevated view has the distinct advantage of making a systemic claim with far-reaching consequences and impact. The world (including food) viewed through the processual lens takes on an additional dimension – that of time. And in relation to this dimension one has to alter how one perceives the world entirely. Objects are not categorized, dichotomized and bifurcated in the processual school of thought. The fundamental of the metaphysics of process philosophy is change, movement and motion. This is merely one version of how to represent reality however and is as such a matter of belief rather than a "matter of fact", just as the modern dualist perspective is more a matter of belief than of fact. As Kuhn explained, convincing anyone to join a new paradigm is more a matter of belief than anything else as proof of the new paradigm is impossible.[42] In this instance, Einstein's famous quote *"God does not play dice with the cosmos"*[43] in his refusal to believe in the quantum theory is especially indicative of how "matters of fact" are unrelated to any external sphere of absolute truth. I.e. in Einstein's opinion he had not been convinced of the validity of quantum physics. Pollan parallels this notion in saying that nutritionism is not a science but an ideology, referring to the common prevailing notion, which treats various fats in food as almost toxic.[44]

[42] "*Like Proust and Berthollet arguing about the composition of chemical compounds, they are bound partly to talk through each other. Though each may hope to convert the other to his way of seeing his science and its problems, neither may hope to prove his case. The competition between paradigms is not the sort of battle that can be resolved by proofs."* (Kuhn, 1962, p. 148)

[43] The quote is attributed to *The Born-Einstein Letters 1916-1955* (2005)

[44] A notion he calls the lipid paradigm. This coupled with notion of input/output of calories is what science writer Gary Taubes have published several books on, blaming most of food related problems on another macronutrient – the carbohydrates. See e.g. (Taubes, 2010).

The shared theme in the above examples is that embracing them will make the things of the world appear in a different perspective. The perspective that Latour in much of his work tries to dismantle is the dualist modern society. Changing belief patterns on this metaphysical level has profound influence on all levels of reality. Indeed, Kuhn's concept of *incommensurability* (Kuhn, 1962) between paradigms reflects this notion. New problems and new solutions within a given field are dependent on the frame of reference and beliefs of the people navigating the field. The problems raised and solved by the rise of quantum mechanics were very different than the ones previously investigated by classical physics. Many aspects of quantum mechanics could not be explained and even contradicted classical physics.[45] The search for a unified theory combining classical and quantum physics has long been a desire in the physicist community; a search that also claimed much of Einstein's attention. The two approaches to physics deal with the same aspects of reality but on different scales of magnification. They currently exist side by side, each seeking to explain their version of reality. Both of them however are necessary in explaining and representing reality. Although sometimes contradictory, together they offer a more fulfilling picture of representing reality than they would on their own. We can pursue this analogy in relation to food, especially with the mechanistic view of food in mind. The perception of food has, as described, followed a path towards increased scientification of food but the problems and challenges of society are far more diverse than at the inception of this scientification. Malthus was concerned about food

[45]An example of this is what Einstein called *spooky action at a distance (spukhafte Fernwirkung)* after publishing the *EPR* paper with Boris Podolsky and Nathan Rosen dealing with the subject (Einstein, Rosen, & Podolsky, 1935). The phenomenon in quantum mechanics is called *entanglement*, popularized as *quantum teleportation* whereby a particle can affect another particle instantaneously over infinite distances thereby, in a sense, circumventing Einstein's notion that nothing can traverse faster than the speed of light. See (Aczel, 2002) for a rundown of entanglement.

supply in relation to an ever increasing population but today's food problems are far more varied and complex than merely concerns of adequate food supply and is ranging, as described, from environmental concerns, health issues and power distribution between states. The mechanistic paradigm of viewing food is simply not capable of addressing all of these issues. The processual view offers, not a replacement, but a counterpart to the mechanistic view and a vast expansion of our perception of food. Taken together these two viewpoints present a thorough advancement in the perception of food and is capable of addressing key concerns in the field of food.

It should now be evident why this paper has avoided going too much into detailed problems related to food. By way of indirect inference the entire field of food is fundamentally changed by looking at it as a process, in contrast to viewing it as fixed objects and fixed dichotomies. Pollan may be overly paranoid in viewing wars fought by the USA in the Middle East as a means to secure oil for an ever increasing agriculture, which is addicted to processes fueled by petrochemicals but such concerns, if they are indeed valid however, are made invisible by not showing the temporal dimension of the being of food.

The question remains however if the methodological approach of viewing food as processes is more accurate depiction of reality. What makes one perspective more valid than any other? To show what is really going on, as Latour states, we must become an ANT and take on the perspective of the ANT, slowly moving and observing everything in detail. To be sure the constructivist argument is powerful in this respect, but again it ultimately comes down to metaphysics.

The current metaphysics in food however has caused an abundance of food, but also an abundance of problems correlated with that metaphysical view of food. The different kinds of nutrients that the mechanistic paradigm has identified ranging from macro nutrients like protein to micronutrients in the form of vitamins and to their sub-parts of amino acids of histidine, leucine isoleucine, lysine etc., have all been enrolled in explaining the cause of health benefits as well as diseases. But is a vitamin-c deficiency really about not getting enough vitamins or it is about not eating enough fresh fruits and vegetables? There is a distinct difference in both the diagnosis as well as the solution of the two statements. By relegating all diseases to the existence or non-existence of nutrients we are all engaging in a sort of collective ignorance disregarding the notion that we are well aware that we do not retain absolute information at any one time.

Then there is the issue of cause and effect. A lack of vitamin-c is not the *cause* of vitamin-c deficiency (scurvy e.g.), instead it is the *effect* of not eating enough vitamins in the diet. The mechanistic paradigm has turned cause and effect upside down and created so much confusion that specific problems and ailments need specific quantifiable cures to make any sense. Ailments that the mechanistic paradigm have helped create in the first place by misinterpreting effect for cause and isolating properties of the perceived cause and administering the results as base for a cure. A shot of vitamin-c does indeed help against scurvy but the shot fails to explain the underlying problem and the real cause of the problem. But "real" in this case also presents a problem as the tangible vitamin-c and the process of getting to the substance are part of the same reality and embracing that fact is, as Kuhn pointed out, a

choice of beliefs, so maybe then the food industry needs its own change of beliefs and reformation of 1517.

Conclusion

This paper has explored how a new definition of food can help solve problems related to food. The theoretical framework of Thomas Kuhn and Bruno Latour shaped the notion that our understanding of food is based on a historical demarcation of Science and Nature beginning in the sixteenth and seventeenth century. Based on this we can trace the scientification of food as it became the object for scientific discovery. It was broken into sub-parts in macronutrients and later micronutrients and ended up as nutritionism - the science concerned with the mapping of the constituents of food. The belief underlying nutritionism is viewing the world as a machine that can be fully known and consequently be manipulated. This was the first definition that the paper explored.

The second was that of food production being viewed as an organism. This view is prevalent within the organic food movement. The organic food movement is a reaction to the industrial food complex and many of the issues raised concerning food are attributed to the problematization carried out by the organic food movement. It can as such help a great deal in understanding how food is perceived. However, the organic food movement is adhering to the same belief as that of the industrial food complex. It views Nature as an external force and independent of human influence. It is for this reason that an entirely new metaphor, a redefinition has been suggested.

Based on the works of Whitehead and Latour, the paper presented the suggestion to view food as a process. Whitehead developed his process philosophy with both quantum mechanics and the relativity of Einstein in mind. In this sense this paper is also an interdisciplinary artifact based on the work on physicists, philosophers and sociologists. The

process philosophy of Whitehead and the advances that Latour has made of it, changes reality as we perceive it on a metaphysical level. It breaks down the demarcation of Science and Nature and shows that reality cannot be viewed as objects and subjects, but is made up of processes and events. If one wishes to describe what is really out there, what reality is, and the temporal aspects, the process has to be taken into account. For this reason, the reductionist school of thought of viewing food as a machine fails to fully explain what food is. A processual approach to describing food will encapsulate both the aspects of being and of becoming. The paper gave examples, in form of illustrations, to propose how a practical implementation could be enacted. It also presented a mini-case study of water as an example of employing a processual mode of thought. The paper then says more about the metaphysics of food then directly addressing specific food issues.

The reason why it did not go into specifics is clear, because by viewing food as an act of becoming it also changes the problems and the solutions. Kuhn mentioned this relationship when discussing paradigm shifts, where views of objects in one paradigm are markedly different from another paradigm. This paper has used different words to convey this fundamental notion. It is not important whether it is called paradigm, school of thought or metaphor. The important thing is first and foremost to enable this kind of thinking about matters which seemingly has an impenetrable infrastructure. By breaking the infrastructure up into paradigms or metaphors an entirely new perspective can be gained and new voices can be heard.

This is the essence of seeing food as a process. The ability to gain new insights into food in areas that once were invisible and to give muffled sounds a voice.

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