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Discomfort Food: How a market for Synthetic Foods is being
assembled

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Abstract

This research follows the discursive productions of human actors in an assemblage that is creating a market for Synthetic Foods. This assemblage, which includes human actants referred to here as *The Movement*, is represented in two major empirical themes. First it is demonstrated how The Movement is attempting to immaterially disassemble conventional Animal Agriculture, by discursively cleaving it from the notion that it produces *natural* foods. Second it is shown how The Movement is constructing a new market for *natural* foods, where animal products are made without animals. The non-human actors of this assemblage are said to be enrolled but this belies the multiple levels of negotiation that are yet to take place. Through collecting and analysing the media productions of The Movement, the discursive performances and relational spaces that constitute this assemblage can be traced. Through tracing these material and immaterial practices the main argument developed here is that a market for Synthetic Foods is being culturally assembled in a series of discursive productions. The Movements discursive texts show an attempt to both, re-qualify what *natural* foods are said to be and then to simultaneously create a spectacle that fixes the identities of actors that supposedly produce them. This can be understood using a Cultural Economy approach which extends the argument by demonstrating that this market assemblage recombines nature with its binary other, culture, in a new way, to form a differently constituted world.

Keywords: cultural economy, assemblage, non-human, nature-culture binary, food, Animal Agriculture, cultured meat, synthetic foods, discourse.

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I hope that my homeland of New Zealand can navigate whatever futures are inflicted upon it and to create futures which are more rewarding for families, like mine that make this place home. I hope that all of the above have meaningful lives and as a result of this work I can say that meaning is something that is becoming in mine.

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Chapter 1 – Introducing Synthetic Foods

1.1 The Problematic

‘There are companies now that are synthesising milk and that is going to disrupt the whole dairy economy’, so said Tony Seba, Lecturer in Entrepreneurship at Stanford University on Radio Live’s ‘Sunday Business’ (Paterson, 2014). At the time, I was working in the dairy industry and this news came as quite a shock. I believed in dairy, I had been trained to and I had promoted it based on its perceived *value* to New Zealand (NZ Hereafter). To compare dairy farming to the horse and cart was confronting from a personal job security point of view and also it was an affront to my perception of our national interests being aligned with Dairy’s economic contribution. Browsing the web, I learned about a company called Muufri that was said to be producing Synthetic Milk. Their discursive statements were of a simplified scientific process where cow DNA is infused into yeast cells and fermented in a bioreactor to produce an exact replica of Cow’s Milk. I decided to investigate further and because of the limited text on Muufri, if I wanted to learn more about Synthetic Foods then I would also have to grapple with the phenomenon of Cultured Meat.

Cultured Meat is the process of growing meat from an animal stem cell biopsy in a bioreactor to produce strings of myocyte cells. The result is said to be the same as processed meat when combined and expanded. This is a simplification of a complex set of practices, promoted by a set of people including but not limited to, animal ethicists and environmentalist entrepreneurs who have combined with venture capitalists to become what I am calling *The Movement*. I refer to this group as The Movement, chiefly because this is how many of them refer to their own collective singularity (eg. Pandya, 2016; Valeti in Harris, 2016; Kim in Holowack, 2016). They have spawned the aforementioned Cowless Milk, Cultured Meat but also Chickenless Egg Whites, Synthetic Shrimp, Chicken, Turkey, Lobster, Shark Fins, Rhino Horns and Gelatin. All this in an effort to create animal products without animals, in a post-animal bioeconomy, that is based on cultural values which include animal rights, environmental sustainability and human health. The named objective of The Movement is to ‘make factory farming obsolete’ (New Harvest, 2016b).

1.2 Why?

This topic is potentially important in helping to solve planet level problems such as Climate Change. If we believe that 97% of climate science publications seem to have reached consensus that human activity has an effect on climate, meaning that aspects of life on the planet are increasingly

precarious (Nuccitelli, 2013) and that livestock are the greatest contributor to this change (Steinfeld et al., 2006), then by creating animal products without animals, the planet can be preserved for the sake of future generations. The environmental arguments on behalf of Synthetic Foods also includes cleaner and more water, less deforestation and reduced land degradation. In addition, the dispersion of such a technology has the potential to feed an ever expanding human population, on a planet experiencing increasingly difficult food cultivation conditions. The environmental and socially equitable utopian future provided by Synthetic Foods might seem like hopes and dreams, but when considered against the very few other solutions offered to planetary problems and the lack of political will to implement any solutions that do gain consensus, then one might be excused for representing these promissory narratives as hopeful.

The promised solution of Synthetic Foods to the problematic of Animal Agriculture has potentially profound consequences for nation states that derive an economic, cultural and social identity from Animal Agriculture such as NZ. The NZ news media cycle follows the Global Dairy Trade auctions that occur fortnightly and when there are significant shifts, especially downward, in the prices of whole milk powder and associated commodities, the accompanying stories are of economic doom and gloom. When a forecast Fonterra payout is revised downward, we invariably hear about how many billions of dollars are flowing out of the NZ economy and what bad news this is for provincial towns and Farmers. China becomes the usual object of derision as if all 1.4 billion citizens are colluding to bring the price of milk down in order to do specific harm to New Zealanders, but this demonisation holds some value in that it helps explain NZ's precariously positional 'resource dependence' (Pfeffer & Salancik, 1978). This dependence presents an imbalance of power between NZ primary producers and the market, in that the producers need the market much more than the market needs any one producer. A cultural change in food markets towards Synthetic Foods, that satisfies world demand for animal products with less negative consequences than from conventional Animal Agriculture, would therefore be consequentially devastating for the primary producers of NZ and perhaps many other nations.

In 2014 agriculture contributed 5.6% of NZ's GDP but is disproportionately crucial to export earnings with Dairy alone making up 28% of total exports in that same year (New Zealand Trade & Enterprise, 2016; Statistics New Zealand, 2015), so if export revenue is prized as being particularly crucial to the health of the economy and therefore the wellbeing of its citizens, then the local Animal Agriculture industry being ravaged by a superior technology is an important thing for a country like NZ to anticipate. Questions to arise might be, what would the rural and urban landscapes look like? What

demographic changes might there be? What planning changes might this involve? What changes in investment might there be to replace the national income foregone? and so on. The swiftness of technological disruption means that the time to plan for replacing a whole industry within a nation's economy might be best started now. After all, Kodak went from revenues of \$16 U.S. billion a year, owning the fifth most recognisable brand in the world and a net worth of \$31 U.S. billion in 1996, to bankrupt in 2012 (Anthony, 2012).

For people whose livelihoods depend upon Animal Agriculture in its current form, it is important to identify a potential threat to the status quo. Informed individuals and organisations might choose to mobilise in at least generating options as to what response might preserve any socio-economic harmony that is said to exist. But this threat has to be set in the context of using up and or destroying the finite resources that might otherwise sustain future generations. The threat from practices of Animal Agriculture might be described as 'negative externalities', where the costs of these practices, such as the cost to clean up rivers, are accounted for by those 'who are external to the economic relationship', like tax payers (Callon, 1998, p. 245). This is an Economics term and traditionally this discipline has much to say on how markets operate.

1.3 More Than Economic

In Social Science the explanation of how markets for new technologies are made, often stems from Economics and Business Studies. These disciplines might explain marketisation using various innovation theories following from Schumpeter's (1994) 'creative destruction', where mutation is necessary for the progression of economic structures, by having agile and innovative new entrants destroy the incumbents. One theory might be Roger's (2003) 'diffusion of innovations', which shows how new technologies have historically diffused throughout markets. Another might be Christensen's (2011) 'disruptive innovations', which might explain how new entrants to a market are able to disrupt long standing incumbents. However, as Christensen (2011, p.xxv) puts it, 'markets that don't exist, can't be analysed' which creates a problem when seeking to analyse a market that is *becoming*. Synthetic Foods which has 'no site of exchange or material package' and therefore cannot be said to materially exist as a market, can yet be seen as a 'cultural product, which is often immaterial' and be can inscribed as an *experience* using devices such as social media, for creatively performing an immaterial market prior to a physical product arriving to a site for purchase (Prince, 2012, p. 139). Synthetic Foods is an immaterial market that is difficult to analyse, but it could be explained in purely economic terms by futuring what might be possible using innovation theory derived from the past, as a guide to speculate.

But here, if speculation is to occur then it will be done using more than primarily economic explanations. This is chiefly to avoid ‘underappreciating how significant a role *culture* plays in making economic and political reasonings’, this underappreciation has arguably led to the ‘post-factual turn’ where Global Financial Crises’, Brexit and Trump could not be foretold using quantitative analytical devices such as those that abound in Economics (Cooper & McFall, 2017, p. 4). Accordingly, a *Cultural Economy* approach will underpin this Thesis and it will be used to show that The Movement are recombining nature and culture in a new way, bringing them together to create the future of food in a market that is becoming material.

1.4 A Cultural Economy Approach

Cultural Economy arose as an alternate way of explaining how aspects of economic life operate. What distinguishes this approach is that it demonstrates how markets are made by various actors, including Economists, through processes that are social and cultural, as well as economic. ‘Economists are just one of a multitude of agents involved in the preparing and repairing of markets’ (Bennett, McFall, & Pryke, 2008, p. 1) and Cultural Economy thinkers have used this insight to critique any ‘fundamental separation between natural and inhuman on the one hand, and the human, social and cultural on the other’ (Bennett, McFall, & Pryke, 2008, p. 3). The Movement as a cluster of entities that use recent technical innovations to create food without animals, is offered here as an example of how ‘culture is working as a force of production and a vector of circulation’ to establish a market (Cooper & McFall, 2017, p. 2). Cultural Economy describes the practices which make economic processes possible, so this informs two objectives in this research. First is to trace the discourses of The Movement and show how new cultural meanings are inscribed upon Animal Agriculture, using discourses to change its identity and *disassemble* it as the provider of *natural* food. Food production is inherently fabricated by cultural processes and practices, yet this constructivism is ignored in traditional economic discussions on agriculture and therefore a Cultural Economy approach will contribute to a fuller discussion of food and agricultural discourses. The second is to follow a different set of discursive statements by The Movement, which *assembles* for itself an identity as the replacement provider of more *natural* animal products. Culture is central to how The Movement argues for a new conception of natural foods and this comes through by following how they practice discourses that enable a new market to be conceived.

This disassembling and assembling has spatial implications. Most obvious is the dispersed nature of The Movement in terms of its actors who are spread across space and time, but because of a shared culture enabled by communication technologies, they often practice in unison to advance the array

of knowledges, practices and technologies associated with producing Synthetic Foods. Geographies of consumption augment these productive spaces as shown through the narratives that pertain to creatively overcoming possible consumption barriers, such as *the ick factor*, where things made in Labs are automatically considered *icky*. The identities of consumers are renegotiated and this can illuminate much about the constructivist nature of markets, which are shaped by discursive and relational spaces that change constantly due to the complexity of ordering a world. It is the messiness of how spaces are constituted that makes Cultural Economy a valuable tool for describing a market being made for Synthetic Foods. An Economic analysis might portray Producers as rationalist capitalist machines, changing the rational behaviour of malleable Consumers to maximise gains via cultural inscription. But actors in The Movement are cultural beings also, overtly so, producing value and cultural capital as much as financial capital. This makes analytically distinguishing between a dualism of culture and economy unnecessary and undesirable.

1.5 Summary of Chapters

Let us now look at how each chapter is constructed. Chapter 2 locates relevant literature produced on the topic of Synthetic Foods. What the literature shows is that Synthetic Foods were initially thought about in terms of *how to* practically combine meat cells using methods which build upon themselves. Cultured Meat is the centre of gravity for the initial genesis of The Movement and this topic dominates the literature. Social Science text on Cultured Meat has appeared of late, using arguments to promote or question Cultured Meat, as an alternative that is becoming stably socialised, prior to a material market developing. This thesis builds on this literature to take account of the whole Movement rather than just Cultured Meat and so includes other Synthetic food products, as well as the relations between actors, both human and non-human.

To outline which theoretical utensils from Social Science have been used within this Thesis, is the job of Chapter 3. Most prominent are Foucauldian *Discourse* and also *Assemblage* Theories but Non-representational theories such as *Affect*, Psychoanalytical theories about *disgust* and other modes such as *framing and overflows*, all make appearances to make sense of different phenomena. To take the first two theories, Foucault's ideas on discourse are used primarily to show how The Movement uses discursive statements that redefine Animal Agriculture's identity as being unnatural and offer Synthetic Foods as being a more natural alternative. Actor-Network Theory inspired Assemblages are used to guide the analysis of how the relations between actors are formed and evolve in a temporary stability which creates a market. The *actors* here are the entities, both human and non-human, that exhibit a potential for enacting agency that might determine how the

operation of the market manifests, if at all. Discourse and Assemblages work to differently translate how we think about *natural* food and Animal Agricultures place in the economy. Because a Cultural Economy approach is critical of an Economist's conception of how economies are made, this approach takes a different turn to the quantitative measuring, modelling or cost-benefit analysis that might be undertaken in Economics. Economic rationalities can and are used here to show, for instance, the economy of scales in Cultured Meat, but Cultural Economy is more meaningful for a thematic media analysis of discourses, due to the overwhelming weight of *cultural* spectacles from The Movement, which are more relational than rational.

Chapter 4 presents the empirical work on how The Movement is using discursive apparatuses to disassemble Animal Agriculture as the provider of *natural* foods. The Movement is shown as an institutional amalgam of actors that are stitched together in a system of power that produces and sustains *truths*. These truths attempt to change the identity of Animal Agriculture, from bucolic provider of natural animal foods where the simplification of pastures being turned into milk or meat is certain, into *Factory Farming*, where unnatural practices give rise to animal cruelty, environmental harm and are dangerous to human health, making any claims for being *natural* uncertain. Factory Farming is the result of nature and culture being culturally cleaved apart, therefore the recombining of the binary is achieved in a new way, through producing more natural Synthetic Foods.

Chapter 5 is a second empirical offering that shows how Synthetic Foods are creatively represented as being the *more* natural provider of edible animal products. The Movement's shared cultural practices bind the actors together and is critical in understanding how an assemblage like this might be stabilised and then how it goes on to perform a market for Synthetic Foods using an array of discursive proclamations. Actors pre-emptively overcome consumer objections as to the naturalness of food grown in a laboratory using simplification, naming and invoking the attractiveness of the actors themselves as well as their investors. The Movement shows how their food is more natural *because* it is not Animal Agriculture, but the more natural Cellular Agriculture. It is further demonstrated that production *scale* is *enacted* to represent Synthetic Foods approaching as an *inevitability*. Finally, The Movement talks on behalf of microbes so that they are said to be auto-enrolled in the Assemblage¹. These are the ways in which Synthetic Foods are installed as a more natural animal food provider, by leaving animals out of the process.

¹ Throughout the Thesis I refer to 'The Movement' as being the human actors promoting Synthetic Foods. They are an Assemblage, but usually when I refer to 'the Assemblage' I mean the wider 'Synthetic Foods Assemblage' which also includes human actors and non-human actors, that relationally linked but not necessarily in a promotional capacity.

Chapter 6 is intentionally entitled 'Discussion' rather than 'Conclusion' because of the number of speculations offered as possible futures, meaning that these ideas can't be ordained as conclusive. This chapter summarises the empirical disassembling and assembling work and then moves on to some speculative possibilities for the spatial, social, cultural, political and economic implications if a successful market was to evolve and what moments might hasten the successful becoming of Synthetic Foods. There is also some evidence of controversies within The Movement that might have the opposite effect on the markets becoming and shows that using Cultural Economy, the post-structural messiness of relational spaces makes markets, technologies and cultures only temporarily stable and contingent.

1.6 Moving on

The first job of this thesis is to introduce to you the actors of the performance. On the next page can be found a Cast of Characters in what I call The Movement. The word *movement* culturally aligns it with other such movements from the past, such as the Civil Rights Movement or the Feminist Movement. Movement also portrays a sense of being in a constant state of becoming, of being mobile. The literature produced about Synthetic Foods, provides context for The Movement's lineage, although it is very much focussed upon the relations that surround Cultured Meat. This literature is difficult to present in a traditional review because of this one dimensional characteristic and because the socialities of Synthetic Foods being so new, much of their nuances are yet to be investigated, leading to a haphazard agglomeration of study. This Thesis is designed to make the entire Movement, better understood as an assemblage of semi-cohered and contingent relations.

Cast of Characters

In alphabetical order. The human actants of the Assemblage mentioned within are:

Bethencourt, Ryan.....	.....Program Director, IndieBio Accelerator
Brin, Sergei.....	....Cofounder Google, Cultured Meat Hamburger Investor
Brown, Ethan.....	.....CEO, Beyond Meats (Plant based Burgers)
Carson, Don.....	.....NZ Farming Commentator
Datar, Isha.....	.....Executive Director, New Harvest
d’Oringy, Gilone.....	.....Chief Development Officer, New Harvest
Ellis, Marianne.....	.....Bioreactor Designer
Elizondo, Arturo.....	.....CEO, Clara Foods (Chickenless Egg Whites)
Gates, Bill.....	.....Cofounder Microsoft, Impossible Foods Investor
Glencross, Abi.....	.....Cellular Agriculture PhD at Kings College, London
Harris, Sam.....	.....Podcaster
Guy, Nathan.....	.....NZ Minister for Primary Industries
Hill, Jeremy.....	.....Fonterra R&D Director
Ka Shing, Li.....	.....Asia’s richest man, Biotech Investor
Kim, Erin.....	.....Communications Director, New Harvest
Luining, Dan.....	.....Research Strategist, New Harvest
MacKay, Jamie.....	.....’The Country’ Radio Host
Pandya, Ryan.....	.....CEO/cofounder Perfect Day Foods (nee Muufri)
Porritt, Sir Jonathon.....	.....Environmentalist
Post, Mark.....	.....Cofounder Mosa Meats
Rubio, Natalie.....	.....Cellular Agriculture PhD at Tufts University, Boston
Seba, Tony.....	.....Author and Lecturer on Entrepreneurship
Shuttleworth, Mark.....	.....Founder, The Shuttleworth Foundation
Stewart, Rachel.....	.....Columnist
Valeti, Uma.....	.....Cardiologist and CEO of Memphis Meats
Verstrate, Peter.....	.....CEO, Mosa Meats

Chapter 2 – Literature Review

The literature on Synthetic Foods is dominated by Cultured Meat texts and this is therefore where this academic discussion on Synthetic Foods begins. Because there is no place where one can go and buy Synthetic Foods, then the literature was necessarily of immaterial imaginings, up until Mark Post's synthetic beef burger patty materialises in 2013, cooked and eaten in front of a live audience and televised as an event. The event is a productive moment not only for The Movement but also for a wave of literature on Cultured Meat. We will track the literature from its biopolitical inception, to where medical technology combines with interplanetary space exploration for enabling the production of Cultured Meat texts. A new credibility offered by these enabling technologies marks an awakening of arguments that ethically moralise Cultured Meat as being an antidote for the problems of Animal Agriculture and simultaneously starts to socialise the idea of Lab produced meat for the consuming public. This Thesis extends upon the literature by incorporating Synthetic Foods as being more than just Cultured Meat. Synthetic Foods is an assemblage of human and non-human actants that are discursively creating a market, where The Movements culture, being cohesively represented, reproduced and extended, is of relational importance.

2.1 Origins

While Synthetic Foods can be perceived as a new technology that has sprung from nowhere, it has taken many moments of technological and social production to become more prominent. The literature here explains how imagined futures can gain credibility and then be framed as a moral necessity when pitted against newly credible environmental and ethical worriments. Winston Churchill (1931) is often represented as being the forebear of claims regarding Synthetic Foods through the quote, '50 years hence, we shall escape the absurdity of growing a whole chicken in order to eat the breast or wing, by growing these parts separately under a suitable medium'. This imagining took a lot longer than 50 years before the material conditions appeared in a laboratory. First, a NASA funded group began experimentation for enabling astronauts to grow meat during long interplanetary space flights (Benjaminson, Gilchrist, & Lorenz, 2002). Second, an art project grew a 'semi-living steak' in 2003 made of frog cells and the artists ate it in the Nantes Art Gallery in front of a tank containing the donating frog so as to question the agency of non-human things (Catts & Zurr, 2008). Margaret Atwood's (2003) novel *Oryx and Crake* performs a similar artistic service where readers are tempted to think about whether the faceless but flesh generating 'Chick-ieNobs' are 'alive' or not (McHugh, 2010). The imagined reality bookended by Churchill and Atwood is intermingled with the credibility provided by NASA and the subsequent actual production of a frog chip that was eaten.

2.2 Framing the Problem

Just because imagined foods *could* materialise doesn't mean they should or will, after all what problem would this solve. Synthetic biologists subsequently began to offer growing meat 'in-vitro' as a counter to the evolving problem constituted by 'the growing concern over the consequences of conventional meat production' (Edelman, McFarland, Mironov, & Matheny, 2005, p. 659). The United Nations Food and Agriculture Organisation gave these concerns a credible impetus by producing a paper called *Livestock's Long Shadow* which implicated Animal Agriculture in many of the most serious threats to the environment including land degradation, climate change, air pollution, water shortage, water pollution and loss of biodiversity (Steinfeld, Gerber, Wassenaar, Castel, & de Haan, 2006). Medical, health and nutritional journals also help this problematisation by pointing to the role of livestock in exacerbating pandemic diseases associated with antibiotic resistance as a result of intensive livestock farming (Walker, Rhubart-Berg, McKenzie, Kelling, & Lawrence, 2005; Weiss & McMichael, 2004). The platform provided by problematising Animal Agriculture, combined with new techniques of growing cells for use in the medical treatment of burns victims and for replacing damaged organs (Mironov, Boland, Trusk, Forgacs, & Markwald, 2003) would provide the tactical competency for the possibility of a new food strategy. Science has published various papers on the biological properties of Cultured Meat, including 'substrate elasticity' (Gilbert et al., 2010) and 'protein scaffolding' (Chien, Makridakis, & Shah, 2012), at a relatively steady rate that denotes technical progress of the technology. This technical competence to overcome a discursively framed threat gives rise to literature that denotes a moral exactitude.

The production of discursive statements from the academy is detectable in many of The Movement's arguments today. Hopkins and Dacey (2008) epitomise this culturally constructivist assemblage by unveiling the 'uncomfortably carnivorous' consumer end of the market that exists between moral vegetarians and meat eaters. As well as implying that meat eating is morally hazardous, they systematically anticipate the objections that do and might surround Cultured Meat and answer them pre-emptively, concluding that the technology might not just be 'an interesting technological phenomenon, but a moral obligation to support' (Hopkins & Dacey, 2008, p. 595). Isha Datar is the current CEO of The Movement's promotional charity called *New Harvest*, but prior to this she co-authored a paper in a Food Science and Innovation Journal, that was heavy on technical methodology, but also laced with subjective discourse that pre-supposed the need for Cultured Meat 'as a humane, safe and environmentally beneficial alternative to slaughtered animal flesh' (Datar & Betti, 2010, p. 13). Some authors go so far as to articulate a utopian view of 'village scale

production' where a 20m³ bioreactor could provide the 'meat demand for 2,560 people' for a year, although the estimated unit costs at the time amounted to €391 per kg (van der Weele & Tramper, 2014).

While many academic texts purport to be about the enabling science of Cultured Meat and overcoming the technical barriers associated with production on an industrial scale (Bhat & Bhat, 2011; Bhat & Fayaz, 2011; Langelaan et al., 2010; Post, 2012), they are interlaced with discursive language of taken for granted notions such as 'tissue engineered meat being the inescapable future of humanity' (Bhat & Bhat, 2011, p. 441). Claims on behalf of Cultured Meat have the appearance of seeming scientifically uncontroversial in the technologies capacity to produce meat humanely and without the negative consequences of Animal Agriculture. One paper attempts to quantify and calculate the claims of Cultured Meats superiority, saying that compared to conventional meat production it would result in 'approximately 7-45% lower energy use, 78-96% lower Greenhouse Gas emissions, 99% lower land use, and 82-96% lower water use depending on the product compared' (Tuomisto & Teixeira De Mattos, 2011, p. 6117). Apart from these advantages, potential benefits offered such as 'producing designer, chemically safe and disease-free meat' mean that, as some argue 'huge funds are desperately required for further research' (Bhat, Kumar, & Fayaz, 2015, p. 241). These narratives that advocate Cultured Meat as an inevitable and morally essential alternative to conventional meat, have been the building blocks on which The Movement has based their discursive statements and are used to construct an assemblage that is performing a market for Synthetic Foods into being.

2.3 Framing and Reframing the Solution

The cooking and tasting of the world's first Cultured Meat Hamburger in front of a live studio audience in August 2013 has been the catalyst for much of the Social Science literature on Synthetic Foods. This carefully stage managed *event* is the subject of a study by O'Riordan, Fotopoulou and Stephens (2016). The paper concluded that the event framed Cultured Meat in order to create a 'promotional public', where normal people can imagine for themselves an identity where they get to be both, a meat eater and saviours of the world, by making Factory Farming obsolete (O'Riordan, Fotopoulou, & Stephens, 2016, p. 12). This same event gave rise to academic texts such as Laestadius (2015), who analysed media content with a view to recommend ways for producers of Cultured Meat to address public concerns and move forward by facilitating public dialogue. Stephens and Ruivenkamp (2016) argue that the event uses 'imagescapes' of in-vitro meat, cells, tissues and flowcharts which play a crucial ontological part in 'framing what in-vitro meat is and what it can do'

(Stephens & Ruivenkamp, 2016, p. 349). This Thesis builds upon this to incorporate images that disassemble Animal Agriculture's identity as natural provider of animal foods and also includes images used in the assembling of Cellular Agriculture being the more natural alternative. A crucial difference is that these images are collected from the whole of The Movement's discourses rather than just those of Cultured Meat.

The semiotic reading of events, text and images is augmented by other methods of research such as Tucker (2014) who investigated consumer perceptions of 'in-vitro meat' using a series of focus groups and found that, at the time of the study, in-vitro meat was likely to be rejected by the consuming public of NZ based upon the sensory perception of it being 'unnatural'. A further cultural insight was that 'participants tended to conflate their personal views with the perception that in-vitro meat would be harmful to NZ's national interests' (Tucker, 2014, p. 174). Using the same method, but now with 'academic experts' as the participants, Mattick, Whetmore and Allenby (2015) workshopped a series of interviews in the form of thought experiments that sought to challenge the taken for granted emancipatory discourses that surround Cultured Meat. This results in a number of potential unintended consequences or 'unknown unknowns' being brainstormed, ranging from inequality between social classes increasing on the one hand and humans losing the ability to chew on the other (Mattick, Wetmore, & Allenby, 2015, p. 64). Dilworth and McGregor (2014) attempt to cross the divide between academic and print media discourses by creating a topology of ethical positions on in-vitro meat. They conclude that, up until 2012, the academic discourses have been generally accepting of Cultured Meat while the print media narratives, in Australia at least, have been generally unsupportive due to its 'unnaturalness' as expressed through the 'yuck' factor (Dilworth & McGregor, 2014, p. 102). The weight of discursive narratives after Post's televised *hamburger event* has increased and this is arguably consequential to what the organisers of the event had in mind to begin with. Some literature is supportive, some less so, but what is important for The Movement is that it has been the catalyst to get Synthetic Foods discussed as a possibility and markets must be discussed if they are to become material.

The swelling of interest around Synthetic Foods has given rise to publications that examine the conditions under which markets are made. Chiles (2013a) uses the 'sociology of expectations' to explain discourses of Cultured Meat, where the future is 'performed' in the here and now if it provides guidance that 'shapes activities and enrolls supporters' (Chiles, 2013, p. 511). The 'promissory narratives' that accompany Cultured Meat can create boundaries for the ethical frames that may either enrol or exclude investors and consumers as shown by the work of Stephens (2013, p.159). The attempt to fabricate a market for Cultured Meat at the very least has been shown to

generate debate over what is considered to be normal or natural within the current Agrifood system and these debates 'gather new societal actors to form new coalitions or rifts' (Driessen & Korthals, 2012, p. 797). Debates on making markets for Cultured Meat, is argued here as being helpful in publicising and legitimising Synthetic Foods, as a thing from the not too distant future, that has affects in the here and now.

While generally the literature has been generous to the possibilities of Cultured Meat, there are papers that begin to question the ethical grounds of its promotion. Galusky (2014) reads Cultured Meat as symptomatic of a failure to create a sustainable food system and Metcalf (2013) is critical of Cultured Meat on similar grounds as it re-routes the problems of Animal Agriculture rather than addressing the central issues. Hocquette (2013) is sceptical of Cultured Meats ability to overcome technological barriers and Miller (2012) worries that the technical sophistication of producing Cultured Meat means that it will be concentrated into the hands of global food corporations. Mattick, Landis and Allenby (2015, p.249) are wary of the rationalisations for Cultured Meat and warn of 'the almost certain unanticipated consequences'. These critiques are concentrated on Cultured Meat only and none adequately address the construction of markets, so this Thesis aims to contribute by extending the analysis to the wider Synthetic Foods Assemblage and to address how a market is being made.

2.4 Summary

The literature on Synthetic Foods is located within the realm of debates on Cultured Meat. The Movement as a whole has not been written about and this thesis hopes to address this. What has been written about Cultured Meat has been a haphazard accumulation of ideas from different sectors of Natural and Social Sciences. The text might cause us to re-think what might be an initial reaction of being present at the birth of a brand new technology as the original conception of meat without animals dates back at least to Churchill in the early 1930's, and has taken over 85 years to reach this point. The early 2000's produced the scientific *how to* literature that was infused with promissory discursive language on futures yet to be performed. The academic narratives from Social Science followed post-hamburger and had initially been supportive of claims that Cultured Meat will overcome the problematic practices of Factory Farming. The process and ethical rationalities of Cultured Meat is where the current literature has been located, what this Thesis considers in addition is how the entire structural edifice of the Synthetic Foods Movement is working to make a market for Synthetic Foods, where new and wider discursive boundaries must be drawn to identify which foods are *natural*. *Discourse Theory* and *Assemblages* are used here to show how new identities are fabricated, which groups the human and non-human actors of The Movement.

Chapter 3 – Conceptual Modes of Thinking

There are many ways in which theory can be applied in order to construct a strategy for thinking about how a market for Synthetic Foods is being made. Some of the innovation and marketisation theories from Economics are already addressed in Chapter 1. If we see markets as evolving in a constant process of ‘becoming’ rather than ‘being’ (Woodward, Dixon, & Jones III, 2009, p. 397), then what appears are attributes that characterise markets as a performative process where culture is a major component. More than just economic processes, markets are interesting sites to investigate relational power that disassembles and assembles. A structuralist approach might explain how systems of knowledges and practices are used to control populations, but while knowledge has enabled power to be concentrated in favour of the ‘bourgeoisie above all others’ and markets made in which excess labour can be appropriated for profit, some argue that ‘the ruling classes don’t know how they do it’ (Hacking, 2002, p. 74).

This Thesis takes a more poststructural Cultural Economy approach to make sense of power relations, as it allows for multiple and relational explanations rather than the simplification of applying the notion of pure power that forces markets into being. The strategy for analysing the Synthetic Foods market is informed by a Foucault inspired mode of thinking about discursive formations that diffuses knowledges, creates practices and fixes identities. To supplement Discourse Theory, we will add Actor-Network inspired Assemblage Theory to better understand the relational spaces of the wider Movement that includes human and non-human agents. Because of the complexity of a Cultural Economy approach which analyses the cultural and social aspects that make economic processes possible, then a range of conceptual devices can be used to partner with a Cultural Economy approach. This toolbox is helpful in drawing out the cultural aspects of how markets are made and these aspects are exemplified by The Movement. In concluding this chapter, a justification for using a thematic media analysis as a tactical information gathering tool that collates secondary data produced by The Movement, will proceed a summary of the conceptual modes of thinking used in this Thesis.

3.1 Discourse

Foucault’s (1979) book *Discipline and Punish* outlines a theoretical perspective on ‘discourses’ that can be used to make sense of what is happening in The Movement. An institution such as The Movement uses discursive statements to create *truths* that are ‘linked in a circular relation with systems of power which produce and sustain it’ and which have the effect of extending this power in ‘regimes of truth’ (Rabinow, 1984 cited in Fairclough, 1992, p. 49). Foucault illustrates this by

focussing on how truth and power is produced within prisons. His genealogy draws comparisons between the classical and modern eras, where punishment in the 18th century is characterised by flamboyant and public displays of hanging and humiliation using devices of sovereign power such as ‘pillories, gallows and scaffolds’. In contrast the modern era uses ‘imprisonment’ as the reformist mode of punishment where ‘bodies are trained in new habits, subject to new disciplinary regimes and their conduct monitored’ (Murdoch, 2005, p. 37). Monitoring through surveillance is a key feature of these new disciplinary spaces and Foucault (1979) illustrates the effect of this using Jeremy Bentham’s Panopticon prison design. In this institution, prisoners were expected to self-regulate their behaviour in the lively expectation that they were constantly being watched, whether they actually were or not. Discourse becomes embedded in the materiality of the prison, which in turn generates discursive knowledge, in this case about prisoners. This ‘knowledge factory’ becomes ‘a permanent observatory’ where knowledge can be used to ‘know’ of crimes (Barker, 1998, p. 56).

Discursive apparatuses that manufacture knowledge can be seen in The Movement through analysing the discursive strategies which disassemble traditional Animal Agriculture as the generator of *natural* foods. It is under the constant surveillance of this alliance that Animal Agriculture and its consumers may operate and this challenges the normality of food in the same way that reformists challenged the normalised public spectacles of punishment in the classical era. Comparisons might be made between the walls of the prison and the boundaries of the Synthetic Foods assemblage, both constructed as locations of calculation, knowledge and normalisation.

As will be shown in empirical chapters 4 and 5, the use of disciplined and repeated narratives is common among many actors of The Movement. This extends the spatial bounds of any one institution or actor and this is where Foucault’s notion of governmentality is important to add into the theoretical mix. Amongst the rationale for adding governmentality is that Foucault describes a fairly extreme version of power in *Discipline and Punish*, whereas in most circumstances as in the case of The Movement, power relations sit somewhere on the continuum between oppression and free play so that the practices can be either positive or negative experiences (Murdoch, 2005, p. 51). ‘Power is implicit in every-day social practices, it hides its own mechanisms, incorporates them and retrofits them to suit its own needs’ (Fairclough, 1992, pp. 50-51) so it is not power that can be seized but, as shown by The Movement, it is the ‘discourses which produce and extend it’ (Foucault, 1979, p. 110). The taken for granted and mundane spaces of power is what Foucault addresses when speaking of ‘governmentality’.

Governmentality or 'the governance of modes of thought' can be considered as a two sided coin, one side being the 'rationalisations' of government, where the ways of thinking about governing are formed and made 'real', which works in tandem with the other side of governmentality being 'technologies', where artefacts such as institutions, legal forms, property rights and agencies 'can process and tackle' this reality (Lemke, 2001, p. 191). Foucault defines government not solely in the political context as we would today, but as 'the conduct of conduct, which ranges from governing the self to the governing of others' (Lemke, 2001, p. 191). This more multifarious expression of political power is observed in a 'profusion of shifting alliances...to govern a multitude of facets of economic activity, social life and individual conduct' (Rose and Miller, 1992 as cited in Murdoch, 2005, p. 44). In this way one can construe that Foucault has attempted to geographically expand his theoretical boundaries by using governmentality as an 'ensemble of historically shifting disciplinary practices' (Giesler & Veresiu, 2014, p. 841). Foucault's ideas on governmentality and discourse will enable a fuller appreciation of the statements produced within The Movement, for export into spaces where a market can be assembled using both the rationalisations and the technologies of government.

The micro-spaces of the prison are an obvious example of how Foucault has used spatial arrangements to frame his analysis, but when his gaze moves beyond particular sites, John Allen (2003 cited in Murdoch, 2005, p. 46) argues that Foucault's spatial focus drifts away and we are left with 'scant detail of the spatial assemblages involved in the management of dispersed populations'. McNay (1994 cited in Murdoch, 2005, p. 49) says that Foucault 'overestimates the effectiveness of disciplinary forms of power'. Perhaps to mitigate this overly negative and oppressive representation of power, first in *'Discipline and Punish'* (Foucault, 1979, p. 95) and reiterated in *'Power/Knowledge'* (1980, p.119 as cited in Waitt, 2005, p. 174) Foucault makes the case for power 'to be considered as a productive network which runs through the whole of the social body, much more than as a negative instance whose function is repression' which gives insight into Foucault's shifting perspective toward a poststructural co-production of power. Foucault (1979 cited in Waitt, 2005, p. 174) explains that 'where there is power...there is resistance...a multiplicity of points of resistance' and in subsequent texts on the theme of sexuality he uses the homosexual community as an example of a network that creatively resisted oppression through inventing their own practices and appropriating their own private spaces.

Foucault's evolving ideas on discourse, are a progression towards arming a poststructural quiver of strategies, where thinking about disciplinary spaces as a result of historically normalised practices

and statements, has necessarily led to thinking about spaces of heterogeneous associations when the spatial boundaries for analysis become too limiting. This is the way that this research on The Movement is approached, investigating a series of discursive micro-spaces that is *becoming* a relational space, constructed to speak on behalf of the market for re-normalised animal meat. Because the micro-spaces are bounded by material and immaterial discursive frames, they can be understood by Foucauldian discourse theory.

3.2 Assemblages

The topographically territorial and the topologically relational when considered together, mix the notions of disassembling and assembling. Synthetic Foods begin life in the territorialised space of the laboratory, where yeast cells are infused with cow DNA to ferment milk and meat biopsies are expanded and multiplied to produce a hamburger. A trio of sociologists, Latour, Callon and Law developed Actor-Network Theory (ANT hereafter) to investigate the power of scientific knowledge in society, produced in the laboratory rather than the prison. Rather than the site being analytically important, it was the effects on society, the topology outside the laboratory walls that was the main focus from ANT's vantage point (Murdoch, 2005, p.57). Actors are effects of a relational network in that they 'are non-existent until they have been stabilised through relational ordering' (Johannesson & Bærenholdt, 2009, p. 15). Actors that are inherently powerful or weak are therefore an impossibility within ANT, as how can something that cannot exist until it is relationally stable be ordained as powerful? It is the relations, the connections and the heterogeneous associations that binds an actor to other actors in a network and makes power a function of temporary stability.

Similarly the notion of scale is disrupted by relationality in that instead of a Euclidean notion of a contained space, 'time and space are the consequences of the ways in which bodies relate to one another' (Latour, 1997 cited in Bingham & Thrift, 2002, p. 289). More precisely than scale being distance, the relations are a topological outcome that is 'performed, in which distance is a function of the relations between the elements' (Mol & Law, 1994, p. 643). ANT, with its 'misunderstandings' due chiefly to the fixity implied by the term 'network' as explained by Latour (1996, pp. 370-371) has morphed into Assemblages and this is a useful concept when thinking about how the material and immaterial manifestations of The Movement are produced and communicated. Once ideas, affects and knowledges are instantaneously beamed around the globe, the sites themselves become less useful and it is the relational effects that become the cogent point of analysis. The translocation of the immaterial over vast, often unknown distances, in temporal calculations which range from

instantaneous to many years if ever, is what Assemblages are designed to help explain and why it is helpful to think of the entire assemblage of Synthetic Foods in this style.

Assemblages can assist in disrupting the taken for granted notional binaries that some argue have been socially constructed in order to reinforce power relations and create the *other* (Anderson, 2013, p. 459). The nature/culture binary loses its clarity of ordered meaning when both human and non-human are given potential agency in effecting an assemblage. The opposite of neatly divided binaries are 'hybrids' that constitute 'complex topologies connecting human and nonhuman actors in living fabrics of association' (Whatmore, 2002, p. 3). Latour (1983) describes a hybrid Assemblage for combating Anthrax created by Pasteur, who leverages power by acting as the 'translator' that speaks for human and non-human actors as a result of a series of negotiations, trials and performances that displaces the lab onto the farm. Callon (1986) exhibits 'translation' in his analysis of three scientists that attempt to make themselves the head of human and non-human populations, for reconstituting scallop fishing in the St. Brieuc Bay. Agency of non-humans and humans is demonstrated as the scallop larvae refuse to bind to the collectors and the fishermen harvest the scallop bed too soon, which destabilises the network and thus 'translation becomes treason' as if to make plain that alliances are only temporarily stable (Callon, 1986, p. 201). The Synthetic Foods Assemblage is a complex hybrid of human and non-human actants, each of which has agency to disrupt the stability of the Assemblage, or reinforce it if the relational associations are translated stably. While Discourse Theory can help unpack the constructed knowledge and statements produced from within institutions, ANT inspired Assemblages can add something when talking about relationality and The Movement.

3.3 Frames, Overflows and Performativity

A key argument in this Thesis is that assembling a market for Synthetic Foods constitutes creating a frame around what Animal Agriculture really is and then what Synthetic Foods are said to be. 'Framing' is an important component of market making, described using a Cultural Economy approach by Callon (1998) as not strictly an economic concept but one from sociology that can be economically applied. Market actors are 'bracketed' within a boundary constructed by material artefacts such as 'property, transactions or contracts' that will allow participation within established conventions (Callon, 1998, p. 256). Bracketing does not presuppose that there is only contact between enrolled actors because contact with the outside world through network connections is inevitable. Markets are not simply economic in that they 'exist in a social vacuum' either. Garcia-Parpet's (2007) research on the construction of a strawberry auction market in Fontaines argues that

markets are economically organised through a culturally mediated process of inclusions and exclusions (p.244). In her vignette, a building is designed to arrange an economically perfect market by separating strawberry buyers from sellers. These frames 'reinforce the social identity of both buyers and sellers' and grants those with power to manipulate this distinction temporary relational power, albeit power 'that might be undermined at any time' (Garcia-Parpet, 2007, p. 246). A farm for example is framed by property rights, supply contracts and labour agreements but also must negotiate with government bureaucracy and consumers in 'cultural tests of felicity' (Callon, 2007, p. 326), but also with non-human animals, weather and equipment. Both Callon and Garcia-Parpet agree that frames are socially constructed and that non-human actors have a say in the mode of fabrication. The concept of framing is symbolic of the discursive battle aimed at disassembling the citadel walls of conventional agriculture and assembling new frames for Synthetic Foods among the debris.

To partner frames, the concept of 'overflows' is also used to describe how Synthetic Foods are coming into being. Overflows describe how the barriers of the frame are permeable when leaks develop and overflows escape the frame, as a consequence, considerable effort is put into plugging leaky frames. Morgan and Murdoch (2000, p.165) describe the vulnerability of agriculture to 'the visibility of environmental externality effects', such as polluted waterways. Agriculture may therefore enter into a contract with the authorities that govern waterways, which enables the costs of containing nitrates and animal waste to be legitimately externalised. The cost is not borne by the farmer, but is accounted for on the tax payer and ecosystem ledgers. Overflows differ from externalities in that they are more than just economic, to take water pollution, it requires re-negotiation when knowledge of the externality becomes visible and the overflows are manifested in terms of mobilised environmental groups, consumer groups and other socio-political actants. The application of frames and overflows is useful in comparing how The Movement are exposing, perhaps widening or even creating overflows. The Movement is itself an overflow, producing a discursive campaign to destabilise Animal Agriculture and create a new frame of Synthetic Foods to provide *natural* animal products.

The performativity of creating and re-creating frames and the performance of containing and creating overflows, are adaptations that must be negotiated in order to stabilise a networked market for Synthetic Foods. An illustration of the performativity of markets is the 'self-fulfilling prophecy', where MacKenzie (2007, p. 77) gives the example of everyone being persuaded that a bank is on the verge of collapse, therefore they withdraw all their money making the bank fold as

expected. In order for there to be a mobilisation of resources to creatively perform frames of containment, the overflows must be measurable (Callon, 2007, p. 256). Centres of calculation create different types of frames for this purpose as shown by MacKenzie (2007) in research on the mathematical frames for knowing the derivatives market using the Black-Scholes Formula. Adey (2008) describes the calculative process of designing architectural frames for people contained within an airport and Anderson (2014) represents the immaterial calculative frames that approximate 'consumer confidence'. The frames performed above have the multifarious roles of mobilising performance in the containing of financial risk, shaping passenger mobility and making consumer affects actionable for business. The framing of Synthetic Foods by The Movement must be done through a series of discursive performances due to there being no *real* product to exchange. Following how the actors are mobilised, or not mobilised is a key feature for this research in determining how a market is being made through performances which qualify Synthetic Foods as *natural* and excludes Animal Agriculture from the association.

The framing, overflowing and performativity of markets at the macro level is dependent on the perceived qualities of the products at the micro level. The qualities of goods can be characterised by their position in time, like a car it can be new, used or crashed. Additionally, goods can be qualified by their different translations, so a car can have different meanings to various actors such as car designers, test drivers, mechanics, insurers and consumers. This points to the contestability of value as a good enters different stages where it is 'qualified and re-qualified' through negotiable scrutiny (Callon, Meadel, & Rabeharisoa, 2003, p. 60-64). The evolution of what is desirable can be culturally mediated in deciding what is valued and revalued in what Callon (2015, p.331) calls 'techno-economic networks'. The increase in value, at least in 'industrialised economies where cultural industries and industries in which culture increasingly plays a part' means goods are increasingly asked to pass cultural tests (McDowell, 2002, p. 690). One such test of quality is 'naturalness', which is a quality that has culturally changed over time and some argue that nature is being re-embedded into food networks because of consumers turn towards a socialised discourse that associates 'quality' with 'natural' and 'local' (Morgan & Murdoch, 2000; Murdoch, Marsden, & Banks, 2000; Parrott, Wilson, & Murdoch, 2002). The concept of what is natural or it's dialectic, unnatural, is a temporarily culturally stabilised construction and is place specific (Rozin, 2005, p.652). The idea of culturally qualifying what is *natural* will need to be negotiated by The Movement to gain consumer acceptance and trust of Synthetic Foods. Animal Agriculture may have to renegotiate and requalify as *natural* and this contest forms the cultural battleground of this controversy.

The manner in which products and their promoters become a success or a failure in creating a market is a function of relational power that simplifies the complex. A micro-actor becomes macro by accumulating relations and successfully translating them into a network on stable terms. An actor can become a 'Leviathan' when they collect enough of these relations and contain them within a 'black box'. The black box metaphor describes a set of 'relations that no longer need to be considered' and the more 'modes of thought, habits, forces and objects' that can be contained within the frame of a black box, the more the actor can orientate their resources towards obtaining new relations without having to re-negotiate with the elements contained within the black box (Callon & Latour, 1981, pp. 284-285). The individual actors disappear and indeed the appearance of a network is no longer visible, it is instead conceived as a 'simplified' and united singularity. A television set is a simplified network that produces pictures and sound, but we could not cope with the complexity of how a show is made let alone the wires and tubes that bring the pictures and sound to life in our living rooms, so instead the need for conceiving of these complex processes is abandoned and the phenomena is simplified into the form of a TV set (Law, 1992, p. 385). The empirical chapters of this thesis show how The Movement black boxes human and non-human actors alike and simplifies the processes involved in creating Synthetic Foods. The Movement requires that those who are receiving their messages, focus on their simplified discursive statements rather than trying to unpick the complexities of how the Synthetic Food is made.

3.4 Affect

Another aspect of relational power that appears in the empirical chapters is that of Affect. While it is difficult to find a stable definition of Affect here this term is used in a Deleuzian sense which describes the embodiment of stimuli through emotion that mobilises a response, 'the motion of emotion' that 'may navigate collective feelings first, by emplacing a set of disciplines, second by engaging a productive, forward sense of self' (Thrift, 2004, p. 69). 'Threat' affectively embodies emotions such as fear, loathing and confusion. Some argue this affect can be used to governmentally rationalise pre-emptive action such as invading Iraq to destroy Saddam's Weapons of Mass Destruction. Affects are difficult to undermine with fact, 'the invasion of Iraq is legitimised despite no Weapons of Mass Destruction being found, yet the invasion persists' (Massumi, 2010, p. 54). Affect shows how the affective 'threat' of planetary degradation due to Animal Agriculture is framed by The Movement in problematising an apocalyptic future that is temporally grounded in the here and now. The mobilisation of affective work severs Animal Agriculture from nature to set up a different recombination of nature and culture through their new technological assemblage, that is to become an economically relevant market.

3.5 Method

Presuming to fix and define the identities of The Movement's actors' risks writing a tendentious account. Callon (1986) prescribes 'free association' as a methodological principle to 'follow the actors with no a-priori assumptions', as any relationships that have not yet been mobilised are impossible to predict and those that are mobilised are free to fluctuate (Callon, 1986, p. 213). Relations that the actors themselves have not specifically invoked will therefore be avoided in this analysis, as 'the goal is to explain how the actors define *their* respective *identities*' and by doing so the risk of fixing the actors positions and identities is mitigated without ever being totally eliminated (Callon, 1986, p. 200). By tracing the discursive moments of The Movement that disassembles Animal Agriculture and then following the actors that are assembling Synthetic Foods, the method chosen is a thematic media analysis. This section will attempt to explain why this method was chosen and what attributes this type of analysis has which informs an ability to understand the Assemblage. Finally, this section will outline the operational plan for the collection of themes to analyse and this will round out the conceptual modes of thinking that has guided this research.

To collect the discursive statements of The Movement I have relied upon secondary data available in the public domain via the internet. The web presents some dangers for qualitative research in that 'it is largely unregulated and anyone can put any information they like on the web without it being checked' (Clark, 2005, p. 68). The unregulated discourses produced for this research are exactly what was required however, in order to represent how the actors of The Movement define and redefine their identities and those of Animal Agriculture. Because the nature of this Thesis is somewhere near the infancy of research into the phenomenon of Synthetic Foods, then the use of the internet as a medium to source data is justified as a reasonable starting point. That the web produces written, visual and audio-visual texts which 'are inescapably political and refocuses our intent upon theorising the workings of power' is not problematic here, as this is precisely what the research is designed to investigate (Aitkin, 2005, p. 234). In other words, what rhetorical themes can be read in the text produced by actors of The Movement that can be used to explain how new discourses are appearing for what we think of as *natural foods*. One of the aims of this research is to find out, what any member of the public with an internet connection can find out about Synthetic Foods. This enables an analysis of what is being attempted in terms of fixing Animal Agriculture as the realm of unnatural food and displaying Synthetic Foods as more natural. The free association to follow the actors enables one to track the thematic texts produced by The Movement which are available via the internet, in the same way as any member of the public could, as a potential consumer of

Synthetic Foods in a market currently under construction. Acknowledged here is that the 'free association' of a researcher that has access to Journal texts, enables a fuller view of the Assemblage, than the 'free association' available to the public who would have to pay for this information per text.

The justification for choosing media texts is predicated upon the ideas that the media forms used by The Movement are entertaining and therefore invite higher participation from the viewer. One might argue that multimedia web texts are produced as much to entertain the viewer as to inform and this forms an integral part of why the analysis of thematic texts surrounding Synthetic Foods is justifiable. To disassemble Animal Agriculture and to assemble a new market amongst its ashes might be seen as an entertaining conflict. Couldry (in Wei, 2015) thinks that, 'participating in social change is entertaining and that entertaining experiences are becoming more enabled through the ease of communication and coupled with this, communication is increasingly difficult to control', so then it might be argued that The Movement are using media that is primarily geared towards entertainment for invoking social change in a way that is rewarding to the participant. If people like to watch stuff break apart and can participate in disassembling Factory Farming that has been framed as an unnatural curse on the planet, then by participating in this way the viewer/consumer are pre-inoculated for supporting a market for Synthetic Foods when (if) one physically manifests. Some discourses chosen for analysis have been borrowed from previous academic analysis of particularly Cultured Meat texts and these are used to both provide context, data and an analysis which might substantiate or provide an opportunity to rethink the arguments here. The analysis of Synthetic Foods via multimedia texts is therefore crucial as this is the site where discursive statements are diffused most widely in a format that might entertain.

To analyse The Movement via thematic media analysis means that not all the actors that might be affected by making a market for Synthetic Foods are represented. The Agrifoods Assemblage, Government and Financial Institutions are examples of food stakeholders whose views are scarcely covered. It is the productions of The Movement and actors that have self-adhered to this Assemblage, that provide the bulk of data here. Similarly, not all actors of the Assemblage are included in this analysis, as some are not considered here as importantly contributing to the major themes of disassembling and assembling Synthetic Foods. The temporal focus has been on collecting data that has been produced in the last five years, as this is when some of the most influential actors of the Assemblage have been most active such as New Harvest, Muufri, Memphis Meats and Mark Post. The Assemblage has been subjectively chosen as the centre of analysis, and then only those actors of The Movement that have produced statements in the major empirical themes of

disassembling and assembling, and then primarily those that have produced statements within the last five years but not exclusively so, as guided by the principle of 'free association' (Callon, 1986, p. 213).

3.6 Summary

Above are the ways in which this research is foundationally built upon established Social Science theories and they are used here as a toolbox approach in the analysis of Synthetic Foods. A mechanic cannot understand the complexities of an engine using just one spanner, so a range of different tools are justified in analysing the cultural and social phenomena of a Cultural Economy approach to market making. Foucault inspired Discourse Theory is relied upon to explain the discursive statements used by The Movement to disassemble Animal Agriculture as being a source of *natural* foods. The disciplined and shared practices of The Movement as evident in the language and actions of the actors shows a progression towards a relational space, where immaterial affects, frames and overflows, combine to perform a rethinking and requalification of Animal Agriculture's relationship to nature. The relationality of Assemblages explains how human actors in The Movement wage discursive arguments for promoting a new thinking about Synthetic Foods being the *natural* provider of animal products for food. Frames can be overflowed and these overflows can create new markets. Differently qualified frames can be innovated into a simplified system of processes that might be called Cultured Meat or Milk Without Cows. These theories sit alongside the empirical findings of this research and each has a job to do in revealing how discourses can both disassemble and assemble. These findings have resulted from a collection of public domain information from the internet via multifarious media texts, but also has been informed from previous research that exists primarily to explain the phenomenon of Cultured Meat. It is to the governing of thought that the empirical story turns to first, where The Movement uses discursive weaponry to crumble the walls and overflow the frames that contains the practices of Animal Agriculture. This frame as the provider of *natural* foods, is what is challenged by The Movement and therefore questions the legitimacy of culture being the binary centre, defined by the othering of nature to the periphery.

Chapter 4 – Disassembling ‘Natural’

And God said, let us make man in our image, after our likeness: and let them have dominion over the fish of the sea, and over the fowl of the air, and over the cattle, and over all the earth, and over every creeping thing that creepeth upon the earth – (Genesis 1:26, The New King James Version)

This chapter will seek to illustrate how The Movement is performing a decoupling of Animal Agriculture from being *natural* through using an array of written, audio-visual, verbal and graphical discursive texts that are often deployed in support of each other. The moves re-represented here are The Movement’s attempts to modify Animal Agriculture’s ‘associations and entities’ in efforts to redefine its identity by ‘problematizing’ its practices (Callon, 1986, p. 203). The Movement provides a definition of Animal Agriculture through highlighting the many ways, in which they say its practices are unnatural. We begin with a section on the statements surrounding animal ethics, which many actors openly say is their prime motivation for destabilising Animal Agriculture. Then the environmental destruction section starts with Animal Agriculture’s effects on water and goes on to highlight some arguments about land use efficiency, deforestation and the level of global warming causing practices attributed to farming. The Human Health section examines concerns over Zoonotic diseases jumping trans-species as a result of antibiotic resistance, which is an argument that is defined by The Movement as being exacerbated by ‘Factory Farming’. The second part of the Human Health section develops arguments from the micro perspective where animal derived foods are offered as harmful to individual health, especially in the form of heart health. What may be most controversial is the attack on Animal Agriculture’s unnaturalness by highlighting the extent to which animal derived food is contaminated by faeces.

‘The great thing about Animal Agriculture is that it is offensive in so many ways’ says Datar as reported in an article on the magazine website *Fast Company* (Richardson, 2016). This statement typifies the broadest frame in a series of ‘nested frames’ (Buenza & Garud, 2007, pp. 31-32) for which environmental, animal ethics and human health concerns are contained within what is usually referred to by the name ‘Factory Farming’ (Datar, 2016a; Pandya, 2015; Valeti, 2016). ‘The act of naming suggests that its centre has been fixed, pinned down, rendered definite’ (Law, 1999, p. 2). The implication of the name ‘Factory Farming’ in my mind is clear, that ‘factories’ and by inference ‘farming’, are relics of the industrial age and they are the very antithesis of natural. The Movement’s disciplined use of the word ‘factory’ when associated with the signifier ‘farming’ constructs a new semiotic sign that represents Animal Agriculture as an unnatural remnant of the industrial age.

This naming foreshadows the main argument in this chapter which is that The Movement are exposing the overflows of Animal Agriculture using discourses that culturally denaturalises Animal Agriculture by redefining what farming is. Proposed here is that The Movement does this by attacking 'Factory Farming' as the discursive target because, first, Concentrated Animal Feed Operations are the predominant farming practice in the U.S.A. and therefore this is the picture The Movement has of what farming is, and second, it suits the empirical controversies more neatly and has wider affective reach than problematising *pastoral farming*.

In NZ and possibly other countries who self-identify with farming as a set of hardy practices that typify a pioneering spirit, an anecdotal observation might be that pastoral farming would be a more challenging target for The Movement to attack, than the comparatively low hanging fruit of Factory Farming. However, if Factory Farming is disrupted then the ability of pastoral farmers to remain competitive will be diminished because of the degradation of scale economies. Calling the enemy 'Factory Farming' may as well just be shortened to 'Farming' but to do so would be to lose the affective distinction that comes with exposing animal welfare, environmental and human health overflows and their potential to reach out and touch all of humanity. Before we move through the disassembling arguments as set out by The Movement, context can be provided by showing how *nature* and *culture* have been genealogically split in successive processes of governmentality. This split necessitates that The Movement re-combines these two elements, before assembling Synthetic Foods as a more natural artefact.

4.1 The Nature vs. Culture Binary Context

Any Kalahari Bushmen or Amazon Indians reading this might immediately, or more likely additionally, be perplexed by the assertion that there is a binate split between nature and culture. Some argue that this split is an illusion that has been constructed by modernity in order to 'serve those that would claim expert knowledge of nature' (Latour, 1993, p. 34). Heretofore the focus is on modern western culture as the broad and simplified frame to explain how nature and culture has been cleaved apart by successive processes. Starting in classical Greek antiquity, Socrates privileged man because of the presence of his soul, useful hands, verbal skills enabled by the tongue and upright carriage, all of which are attributes endowed by the Gods. Christianity then took up the mantle for speaking on behalf of nature with the anthropocentric Genesis stories of creation from 'natural theology'.

This God given superiority has translated into a 'utilitarian conception of nature...where technology is directed toward short term profits in a developers mentality' where the efficiency with which

nature can be turned into cash was argued by some as being the philosophy which has driven the unprecedented transformation of nature since the 19th century (Glacken, 1992, pp. 104-107). Using the UK dairy industry as an example to illustrate this transformation, the urban boundaries were redrawn in the late 19th century, so that they may be 'purified' from Dairies which were displaced into the rural hinterland in a double movement that made the cities cleaner and also milk more 'natural' (Atkins, 2010, p. xix). These are illustrations of how *nature* is set up outside of *culture* and apart from society, banished to a hinterland where they cannot be seen from the citadels of human achievement and therefore the products of *nature* arrive back as the achievements of unseen systems, made clean by technology and somewhat paradoxically, more natural.

Ecological movements have sought to challenge the discourse of human exceptionalism on the grounds that it 'facilitates an unwarranted exploitation of nature' that has resulted in some unforeseen ecological consequences (Murdoch, 2001, p. 112). In another UK example, the paradox exists where 'preservationists' *reinforce* rather than resist the dualism, in order to protect 'rural' areas from encroachment using governmental power apparatuses such as 'the Town and Country Planning Act, 1947' for keeping the countryside 'authentic' (Murdoch, 2005, p. 126). In NZ, nature is more commonly thought of as 'wilderness' due to the relative recentness of farming practices that have carved pastures from forests in an unprecedented flurry of 'productivism' (Cumberland, 1961; Pawson & Brooking, 2000). The goal here is not to try and resolve the dualism, but merely to point out that in western cultures at least, the dialectic is assumed to exist and it informs a myriad of practices. The place of *nature* has been negotiated over time and there are differences in spatial conceptions of what *nature* is and what its relationship to *culture* is said to be. The 'othering' (Anderson, 2013, p. 459) of nature and the displacing of the non-human, is necessary in order to exploit animals on an industrial scale.

4.2 Animal Welfare

It is not hard to discover that animal welfare issues represent a prominent ethical driver for the development of Synthetic Foods. A number of the actors are vegan including Pandya (Rodriguez-Fernandez, 2016) and he signals the importance of animal welfare saying that it 'is the underlying theme that brings this movement together' (Pandya, 2016). This theme informs a procession of discursive apparatuses which represents farming as being unnaturally cruel. When talking about the processing of animals for meat the most common name used by The Movement is 'slaughter'. Valeti best encapsulates this in the story of how he as a child, became uncomfortable with meat as a result of attending a 12 year olds birthday party in India. He wandered off and came across the blood

soaked dirt floor of a makeshift slaughterhouse where men were killing animals to provide a birthday party's meat (Burningham, 2016; Valeti, 2016). This narration of discovering a horrific and 'deliberately concealed backstage performance' (Goffman, 1971 as cited in Mansvelt, 2005, p. 89), simultaneously associates a birthday and a deathday where the end state of farming, for animals, is unnatural and inhuman. The imagined image of a horrified young Indian child decentres meat as a product of nature. Datar uses the word 'slaughter' to reinforce the distinction between natural Cultured Meat and unnatural 'slaughtered' meat by explaining that Memphis Meat's Cultured Meatball 'is the exact same meat, I'm going to reiterate, but it came from cell cultures instead of a slaughtered animal' (Datar, 2016d). The disciplined and repeated use of the word *slaughter* helps challenge thoughts on meat by bringing home the visceral reality of what meat actually is, what it was and what had to happen to it so it could change frames in a socially acceptable way for consumers.

Research has offered some thoughts on how human's treatment of animals can be valorised, because the 'visual disconnect between supermarket meat and slaughterhouse practices...makes the unnecessary pain and suffering...easy to ignore' (Hopkins & Dacey, 2008, pp. 579-581). Hopkins and Dacey (2008, p.580) pose a thought experiment where they wonder how popular cooking shows would remain if the contestants had to butcher any animals used in a dish on live TV. The important part of this debate is that its origins come from taking the anthropocentric conception of animal terror and concealing it within a notional 'black box' (Callon & Latour, 1981, p. 285). This black box auto-enrols animals into a network for feeding humans, their compliance and identity are fixed without any further negotiation required in order to understand the depths of their terror.

Besides The Movement's evocation of 'slaughter' and the 'black-boxing' of animal suffering, there are visual animal welfare mechanisms used in producing the *unnatural* discourse. At the food convention 'Bitten 2016', Datar uses the following image at Figure 1 to contrast farming and nature saying, 'yes it's great to think of animals raised on farms outside, but that is a very, very small fraction of where our animal farms come from'.

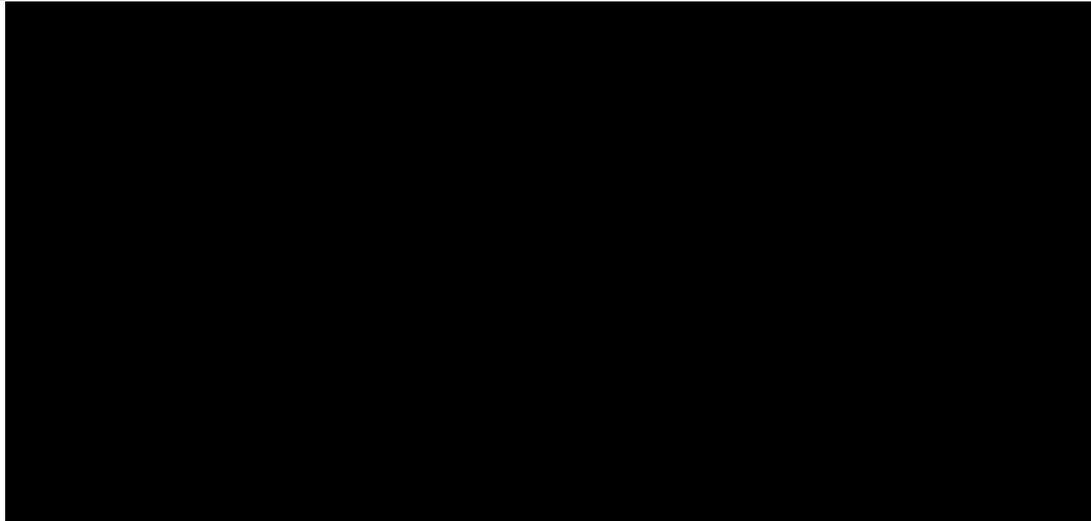


Figure 1. Datar, I. (2016d, February 29). *On Animal Products Without Animals* [Video File]. Retrieved from <https://www.youtube.com/watch?v=5FbQ89PFSsk&feature=youtu.be>

The image contains the accoutrements of cages, concrete walls and bright lights but is also notable for the amount of animal faeces present in the corridor, which reinforces the *ickiness* of Factory Farms along with their *cruelty*. She goes on to say that ‘this is actually not too bad of a farm, it’s not amazing, it’s not clean, it’s not safe’ which is a statement that reflects that the cruelty of caged animals wallowing in their own faeces, is the status quo for Animal Agriculture (Datar, 2016d).



Figure 2. Sanchez, M. J. (2008). [Untitled File Photograph of Battery Hens in Cages]. Retrieved from <http://www.ctvnews.ca/sci-tech/cultured-meat-milk-and-eggs-poised-to-enter-grocery-stores-1.2811263>

An article by CCTV (China Central TV) News California, uses the ‘file photo’ in Figure 2, of battery hens to make a similar point (Sagan, 2016). The artefacts of cages and cramped conditions is a representation of the unnatural process for creating eggs and chicken meat. The article features quotes from Elizondo, who speaks on the topics of ‘production

scaling’ and ‘release timeframe’s’ for his product ‘Chickenless Eggs’, but is *not* quoted on animal ethics. The article conflates what his views on animal welfare issues for chickens will *probably* be, by associating the quoted textual content with the ‘file photo’. This is an example of media assisting in the work of The Movement by using discursive devices in order to make a ‘promotional public’

(O’Riordan et al., 2016), where the public are offered a chance to become familiar with the technology and also offered a chance to think about the appalling treatment of hens before making a far off decision on whether they will consume Clara Foods ‘Chickenless Egg-Whites’ or continue exploiting chickens by supporting the status quo.

By naming the end state of Animal Agriculture ‘slaughter’, by telling stories about the horrific events of a child witnessing animals being destroyed on a birthday/deathday and reattaching what has been visually disconnected through the separate structures of the slaughterhouse and the supermarket, The Movement cracks open the lid on the supposedly stable black box of conventional Animal Agriculture, and exposes the overflows. These discursive statements and images are part of the architecture for governing a change in thought for potential advocates of Synthetic Foods, thoughts that disassemble farming from being considered natural. Farming necessarily breeds, sometimes or often mistreats and mass exterminates animals. These claims are relatively uncontroversial, just hidden.

4.3 Environmental Destruction

The next discursive lance that The Movement wields is that of environmental destruction. Under this general heading it will be shown that The Movement uses a combination of images and statistics to impart the gravity of change induced by Animal Agriculture. Here The Movement does not distinguish between Factory Farming and Pastoral Farming, instead they are lumped together for maximum affective governance of thought. The Movement problematises Animal Agriculture’s effect on water, deforestation and efficient land use and re-represents commentary about its effects on climate change.

4.3.1 Water

Primarily The Movement can be seen as a name for the scientists and investors developing Synthetic Foods. But as we have seen above with the news media, it could also be argued that there is a wider assemblage, where actors sometimes become attached to help perform the discursive tasks of unbinding Animal Agriculture from being natural. One example is a critique that highlights farming’s consequences on water.

Motion picture documentaries like *Cowspiracy* (2014) and *Last Call at the Oasis* (2012), critiques farming’s claims of being natural and have potentially been among the most widely disseminated texts. These ‘media events are largely deterritorialised’ and act as an important conduit of relational

power in a 'globalised and digitised media culture' (Couldry, Hepp and Krotz, 2010 cited in Cross, 2011, p.380). *Cowspiracy* (2014) argues that the practices of resource overuse, effluent disposal and fertiliser application contribute to water scarcity, pollution and downstream effects such as the 'dead zones' in the Gulf of Mexico. *Last Call* (2012) more specifically highlights the economic consequences of water overconsumption if intensification of farming continues. Its vignettes problematise overconsumption of water by highlighting the spatially diverse consequences for nature and society in drought stricken Australia and California's Central Valley, bringing the macro problem to bear on micro-locals. Consumers as voters with collective political power are rallied by the film to join an assemblage that pressures political actors into acting against corporate polluters, of which it is offered that farming is the number one contributor.

Activist documentaries may be heavily slanted accounts, but they use affective audio-visual portrayals to problematise farming as being the domain of natural food. In *Last Call* (2012) this is added to, as shown in Figure 3, by comparing common and visible uses of water with hidden uses of water, such as the beautiful image of a swimming pool on a hot day and the steak being BBQ'd next

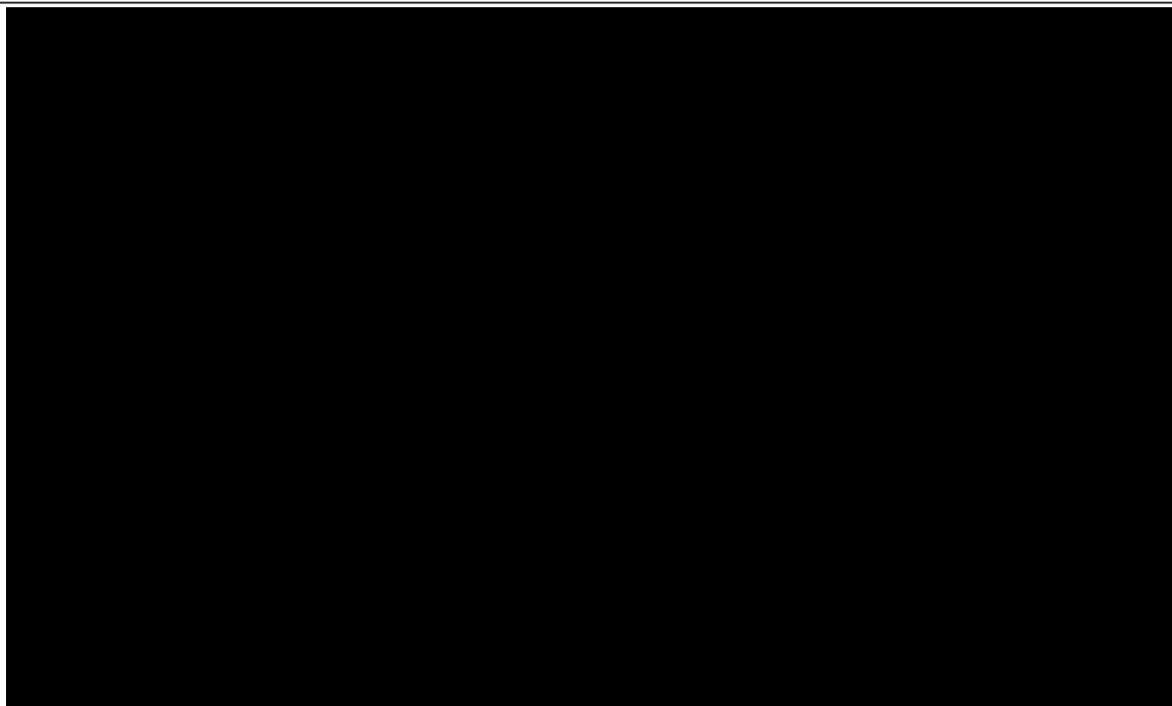


Figure 3. Yu, J. D. (2012). *Last Call at the Oasis* [Motion Picture]. United States: ATO Pictures

to it, in which it is claimed that both have used 18,000 gallons to produce. The problematising of farming's unnatural use of water is communicated through *relational statistics*, this time verbally rather than the medium of film. Relating how much water it takes to create milk, Ryan Pandya says

to an audience that 'it takes 1000L of water to make 1L of milk' (Pandya, 2016). The affective comparison, provokes a sense of outrage at the inefficiency.

The notion of water being 'used' is a statement about water often repeated by The Movement, and gives the impression that it disappears, which is not necessarily the case. The image in Figure 4 is of

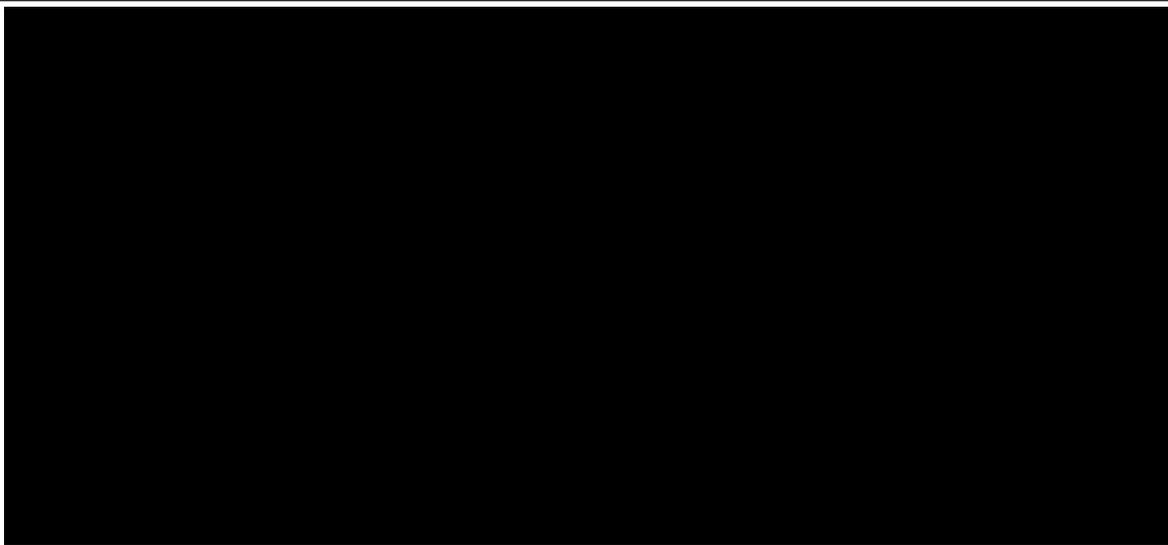


Figure 4. Datar, I. (2016d). *On Animal Products Without Animals* [Video File]. Retrieved from <https://www.youtube.com/watch?v=5FbQ89PFSsk&feature=youtu.be>

a Feedlot used in a presentation by Datar (2016d) and she affectively uses it to illustrate that The Movement interprets *used* to mean *poisoned*, saying 'all of the runoff from this feedlot causes this massive algal bloom in an area of water nearby'. Datar is quoted elsewhere saying '30% of fresh water is used for the production of animal products' (Datar, 2016a). The accuracy of statistics concerning usage of water by livestock might be questionable, but following that line of enquiry inevitably has one confront the social science critique concerning the constructivism of all scientifically generated knowledge (See Kuhn & Hacking, 2012; Latour & Woolgar, 2013). For the purposes of constructing a discursive statement that seeks to morph into a generally held belief, *accuracy* of statistics may not be the defining pre-requisite, rather it is frequency, surety of delivery, its mobility in reaching globally dispersed audiences and the perceived credibility of the actor delivering that statement, which is most important.

As has been done with news media and documentary film actants, lets now take *science* as the broad frame of actors that categorise *knowledge* about farming's unnatural impact on water. There are relations within The Movement between actors that might give the impression of impartial scientific rigour. Among these associations are representations of an 'Life Cycle Anticipatory Analysis' from Mattick, Landis, Allenby and Genovese (2015) that assesses the environmental

advantages of Cultured Meat over conventional meat including the improved 'Eutrophication Potential' (nutrients that increase algae and starve water of oxygen) which presupposes that eutrophication is a problem caused by conventional farming. Genovese, the fourth author in that paper, is listed as belonging to the 'Department of Medicine, University of Minnesota' (Mattick et al., 2015, p.11941) rather than being Genovese, Co-founder and Chief Science Officer of 'Memphis Meats' (Memphis Meats, 2016a). *Scientific knowledge* is used as a delivery mechanism for critiques about livestock's effect on water, where this same *knowledge* produced by a commercial actor may seem less independent and therefore less credible.

The credible sounding, United Nations Food and Agriculture Organisation (FAO) report titled *Livestock's Long Shadow* is often cited by The Movement in decentering farming as natural. On water the FAO concludes that 'livestock is one of the most damaging sectors to scarce water resources, contributing to pollution, eutrophication, degeneration of coral reefs, disturbance of water cycles and contamination of oceans' (Steinfeld et al., 2006, p.xxii). In 'clean green' NZ, science critiques livestock by saying that Animal Agriculture has had dramatic effects on the quality of water including '84% of lakes in pastoral catchments' being polluted and '62% of the length of all NZ rivers being unsafe to swim in' (Joy, 2016). While scientific and academic texts are less likely to be widely disseminated among the public than films or images, they provide the spectre of credible ammunition for The Movements re-represented knowledge on Animal Agriculture's unnatural effects on water.

The political sentiment on Animal Agriculture's impact to the NZ environment is supported by other actors. Notables such as Sir Jonathon Porritt, founder of 'The Foundation for the Future' and chair of 'Air NZ's Sustainability Panel', who told assembled political and community members in Auckland that, 'it seems to me now that we're at a point where NZ absolutely cannot go on doing that any longer', referring to the Dairy Industry's intensification which has done 'horrendous' damage to waterways and soil quality. The success of the industry has been achieved 'only because it was given permission to degrade significantly the natural capital on which it depends' and this was 'not clever' (Moore, 2016). A critical reading of these statements might be made in the context of Sir Porritt advocating changes to Animal Agriculture that might benefit tourism and therefore Air NZ.

Science and politics merge as the above discursive statements assist in, not just decoupling *Animal Agriculture* from *natural*, but in making it the abject enemy of natural. UK Minister for 'Life Sciences', George Freeman problematises Animal Agriculture on behalf of the world by saying that 'by 2050

we're going to have to double world food production using the same amount of land and half the amount of water and energy' naming it 'The 4th industrial revolution' (Freeman, 2016). The politicisation of water in dispersed political economy discourses shows how multifarious and geographically diverse the actors are, and their arguments travel between spaces to redirect thought about the relations between Animal Agriculture and nature.

In summary, by invoking *water* as being threatened by Factory Farming, the above narratives strike at the heart of one of humanities most basic needs, access to fresh water. Assembled actors', including those from The Movement, media, academy, business and politics, use a progression of multifarious statements about water. These statements are reproduced and embedded in a discursive governmentality which associates farming with inefficient use and pollution of our shared water and it is hard to imagine any portion of society that is not affected by changes in water resources. In short, Animal Agriculture is portrayed as using and/or polluting all of our fresh water, and if the public want to reverse the damage and preserve fresh water stocks, all they need do is change where they source their animal derived foods from and The Movement promises to materialise this solution.

4.3.2 Deforestation

Deforestation due to Animal Agriculture is usually framed by The Movement using the Amazon Rainforest as an illustration. One prominent actor from The Movement in this discursive space has been Pandya. He reproduces the statistic that 'In *fact* 91% of the degradation of the amazon is due to Animal Agriculture' (Pandya, 2016). The Amazon vignette is buttressed by other statistics that point out how inefficient Animal Agriculture is for land use, for example 'the alarming facts are that 70% of all agricultural land is used for livestock production' (Datar, 2016a) and 'demand for meat, which is projected to rise by 10% to 100 lb's per person by 2030 is not remotely sustainable, not with livestock already consuming one-third of all grain worldwide, and dominating agricultural land use' (Richardson, 2016). This last jumble of statistics is not made clear via quotation marks whether Datar is the provider, although the article is about her, or whether the statistics are represented by the author. In any case this word salad might appeal to consumers who have not thought about how much their aggregate meat consumption accumulates to per year, or consumers who wonder why the price of their grain products seems to keep rising or consumers who find land for their own purposes scarce and are outraged by agriculture *dominating* the availability.

The use of image and statistic together are combined to decouple Animal Agriculture from natural by Pandya (2016) in a presentation slide shown in Figure 5. The image of happy cows in green pastures are contrasted with 'reality' when Pandya says that 'the bucolic imagery of the family farm that you see on the back of your milk carton is not reality, this is reality' and an image of a concentrated livestock operation on grass devoid scorched earth is shown. Overlaying the image is a statistic, with an accompanying reference from Jonathan Safran Foer's book *Eating Animals* which states that '99% of all land animals eaten or used to produce milk and eggs in the United States are *factory farmed* [emphasis added]' (Pandya, 2016). The corollary is that 'even if you think you're avoiding it, you're not' which leaves the viewer very little option other than to question their support of the status quo and by extension their conception of farming as being natural, if they find this land use argument compelling (Pandya, 2016). The use of confronting statistics and images are

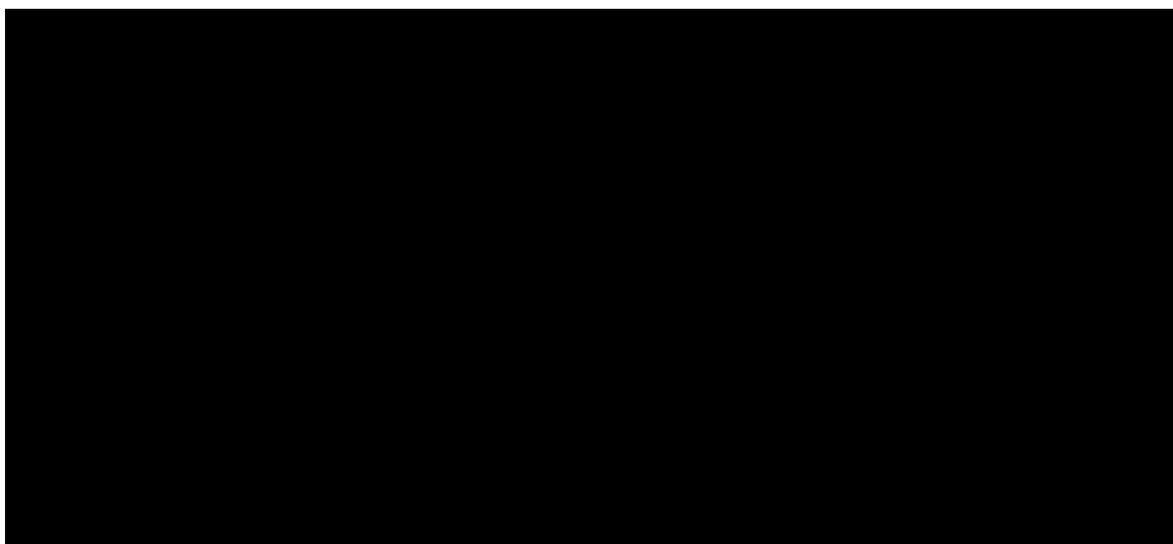


Figure 5. Pandya, R. (2016, March 16). *Developing the Animal-Free Future of Dairy* [Video File]. Retrieved from <https://www.youtube.com/watch?v=vv7gjWg5wTY>

thus corralled into a series of statements that argues for livestock production being the antithesis of *natural*, in geographies that span from Brazil to the United States. The best thing to do as a remedy for these overflows is to forgo participating in the status quo of Animal Agriculture.

4.3.3 Climate Change

There is a global non-human assemblage that we cannot opt out of using, namely the atmosphere and its link to climate which effects the very conditions of survival. The Movement once again turns to statistics and normalising statements to do the discursive work of denaturing Animal Agriculture, although with climate, presumably because it is comparatively difficult to represent visually, there are no accompanying images. 'Animal Agriculture has a larger effect on anthropogenic greenhouse gas emissions, than every type of transport combined' (Pandya, 2016). This idea is reinforced by The

Movement using varying statistics about what portion of global greenhouse gases are produced by livestock, which ranges from '14.5%' (Burningham, 2016) to 'between 15% and 24%' (Datar & Betti, 2010, p. 20) to 18% (Steinfeld et al., 2006, p. xxi), but it is what this statistic is compared to that does the more important discursive work. Each of the sources above makes the deliberate comparison to it being more than *all transport combined*, or to add colour to the narrative 'more than all the cars, trucks, planes and boats in the world' (Burningham, 2016).

This comparison is disruptive to the generally assumed notion that the greatest climatological hazard is engine emissions. Climate change might typically conjure up images of smog filled cities due to the abundance of fuel driven transportation in confined areas. There are multiple possibilities about why the internal combustion engine seems so much more vilified than cow farts (or more precisely cow burps) and arguably one reason is its visibility. When an old truck passes us on the road, spewing clouds of black smoke, it is more recognisably harmful and probably requires less cultural change than stopping the consumption of conventional meat 'which accounts for 9% carbon-dioxide, 39% methane and 65% of Nitrous Oxide' (Pandurangan & Kim, 2015, p. 5391).

Other actors, not necessarily from The Movement, but who helpfully reinforce their arguments concerning climate change, are temporarily attached to the Assemblage for the purposes of providing credible futuring of fears yet unrealised. Because these fears are felt today the future has an affective impact in the here and now (Massumi, 2010). In one example of transporting the future into the present, researchers use the 'global warming safe limit' which suggests 'we will reach the upper limit of 2 degrees centigrade absolute limit from pre-industrial age temperatures, set at the 2015 Paris UN conference on climate change, by 2030' (Wagner, Ross, Foster, & Hankamer, 2016, p. 11). This statement links the actions of today with the governmental hopes of yesterday (2015) and simultaneously with an apocalyptically certain future (2030). The use of non-exact statistics and statistics that are represented as being very exact, is for the second time in this chapter combined with personalised narrative when Pandya (2016) recounts that 'we know a guy that refuses to travel by air, but eats meat like no tomorrow...you're undoing every flight you could have taken for 10 lifetimes with every steak you eat'. This is as much to say that consumers who like steak and have ever taken a plane ride cannot, given the current meat production system, do anything to mitigate the impact of eating meat and therefore the climate requires a new system for producing it.

This new system of animal products without animals is predicated upon the legitimacy provided by produced and reproduced statistics which have less to do with providing an accurate account and

more to do with providing a platform for making farming more unnatural than even the overflows of the internal combustion engine. That manmade climate change exists, is relatively uncontroversial now as the work has been done to normalise this concept in many people's minds, The Movement just reiterates it and makes the issue urgent. The Movement argues that the planet is in need of a cultural change because 'with climate change we don't have the option to wait longer' (Pandya, 2015). Like the arguments concerning water and deforestation, that problematise Animal Agriculture's conception of being *natural*, climate change is a future problem brought into the here and now by The Movement, for affective action by a promotional public that might now view farming as anti-nature in a way that might mobilise them to change consuming practices if a better alternative is offered.

4.4 Human Health

The controversies of concentrated Animal Agriculture, named Factory Farming, effecting human health are used by The Movement to separate the association between Animal Agriculture and naturalness. The drama of zoonotic diseases such as Bird Flu, Swine Flu and BSE (Mad Cow Disease) are used by The Movement as examples that reinforce the disassociation. Their arguments link the unsanitary conditions of Factory Farms, with the *need* and subsequent overuse of antibiotics to maintain its practices. Antibiotic resistance is offered as the cause of zoonotic disease. The Movement personalises the harmful outcomes of conventional animal food products by re-emphasising the risks associated with eating even uncontaminated goods, such as red meat's correlation to heart disease. Just to make sure that the nature/farming discursive alliance is divided, the theme of faecal contamination is introduced as a shocking reminder of what people are eating.

Zoonotic diseases are those that originate in non-human animals and then spread to humans. Anthrax is one example that affectively registered with societies soon after Animal Agriculture became industrialised. Whether the spread of some diseases is now more prevalent or not is debateable, but the representation in Figure 6 on the following page, by Datar (2016d) leaves no doubt, Factory Farming is to blame:

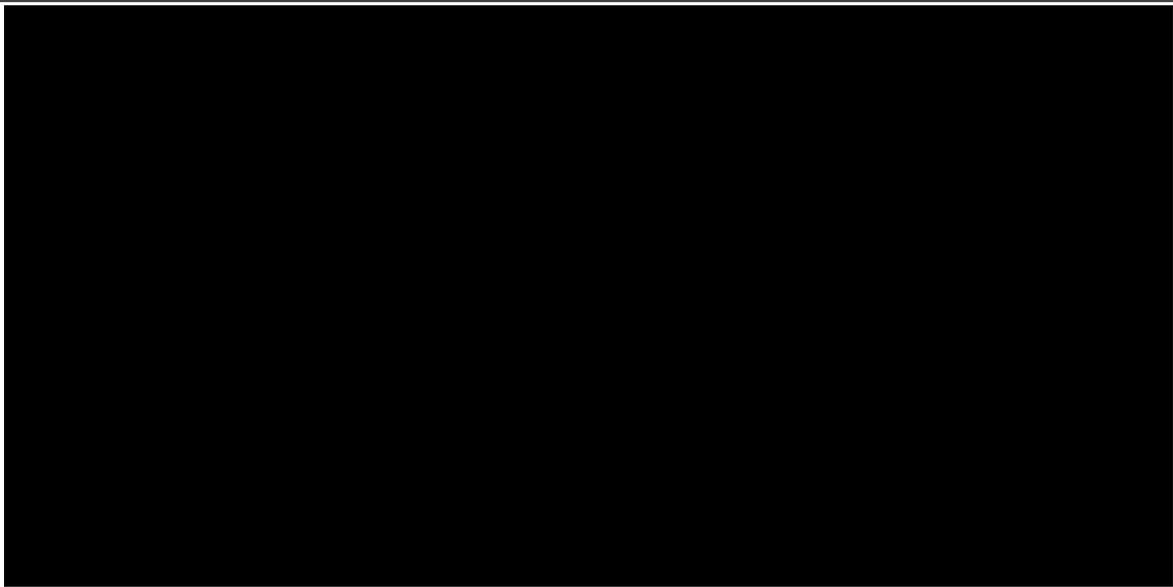


Figure 6. Datar, I. (2016d, February 29). *On Animal Products Without Animals* [Video File]. Retrieved from <https://www.youtube.com/watch?v=5FbQ89PFSsk&feature=youtu.be>

The other problem with factory farming is that it's very, very unsafe...this is an image [at Figure 6] of chickens that had to be culled to contain bird flu. These kinds of bird flus and animal flus are happening more and more often and that's because Animal Agriculture is becoming more and more intense. As you can imagine when you have animals packed in close environments you have the perfect breeding ground for disease where avian flus that used to be quite mild and not too different from our flus have an opportunity to become very virulent and pathogenic and therefore very deadly (Datar, 2016d).

This quote and accompanying image of people in biohazard suits stuffing an estimated '50 million culled chickens' into rubbish bags, encapsulates The Movements view (Datar, 2016d). What is interesting is that this image contains only birds, but the words 'and animal flus' extends the narrative beyond birds to encompass all forms of Animal Agriculture. The diseases themselves may be contagious, but so too are the narrative statements. Scientific statements provide a credibility to the narrative saying 'avian and swine influenza viruses are associated with livestock farming and anthropogenic developments in the bio-industry' (Pandurangan & Kim, 2015, p. 5392). The Movement links the prevalence of Zoonotic disease with the Factory Farming practice of overusing antibiotics. Valeti typifies this saying:

there is nothing natural about the meat we're eating now...because they're grown in such intense confined conditions, let's say a thousand pigs in a small barn that's covered in faeces and waste material, they have to pump these pigs with antibiotics, which leads to antibiotic resistance and superbugs and also sets up the stage for really bad zoonotic diseases (Harris, 2016).

In a curious human health related twist, that might fall into the category of biting the hand that feeds, or more importantly the hand that regulates, Harris while interviewing Valeti states his concern that 'the USDA at one point made it illegal to test for BSE because they didn't want to set a precedent requiring everyone to test for it' (Harris, 2016). This highlights the denatured process of making conventional meat, while implicating government agencies in subterfuge that is advantageous to Animal Agriculture. By implication then, this subterfuge lures those that distrust anything government related and by extension associates this distrust across to Animal Agriculture.

The Movement says that Factory Farming's hyper-concentration of animals, means they are living in filthy conditions, which means they require constant dosing with antibiotics. The Movement says these practices are to blame for Zoonotic disease outbreaks, but also that antibiotics can be passed to humans as a food contaminant. Valeti makes this clear by making a normalising statement which is presupposed as uncontroversial in that 'our cells (Cultured Meat cells) are going into meat without any of the chemicals or antibiotics that *are* typically on our plate' (Niu, 2016). Elsewhere, antibiotics are implicated in E.coli poisoning because 'when cows are fed on grain then they produce more E.coli bacteria that become resistant when constantly treated with antibiotics, which means that the frequency of outbreaks of E.coli poisoning is on the increase and the E.coli are more deadly' (Kenner, 2008). The issue of antibiotic resistance seems to be like a war between different factions of science. On one hand pharmaceutical companies and veterinarians are inclined to use antibiotics as a technological device for feeding an ever increasing world population, on the other hand, The Movement uses the same practices and products to problematise Animal Agriculture as being unnatural. It is the effects on collective humanity that are problematised, but individual humans are the ones that require mobilising if a changing culture is to take place that denatures Animal Agriculture.

So to individualise health concerns, The Movement manages to distil human health effects down to the level of the individual and even further into the micro, down to individual organ level. This is a feat reserved for the more scientifically credible actors such as Valeti, or as he is mostly introduced, as 'Uma Valeti Cardiologist and CEO of Memphis Meats' who is well aware of the harmful effects of 'red meat overconsumption as a result of research into how heart muscle can be regrown' (Harris,

2016). The work of disassembling the naturalness of Animal Agriculture is assisted by other *credible* and *independent* science publications which problematise red meat consumption as ‘associated with some health problems such as cardiovascular diseases, diabetes, and colorectal cancer’ (Pandurangan & Kim, 2015). One might think that these discourses would be of a hindrance to a meat company like Memphis Meats which produces Cultured Meat that is *just like* real meat, but because it divides nature from Animal Agriculture in the present, it may possibly damage the status quo more than the future alternative and, as we will see in Chapter 5, the alternative of Cultured Meat may be rendered scientifically advantageous for heart health. Although problematising the health of the human heart is perhaps an obvious discursive statement from The Movement, the invocation of ‘colorectal’ signals a body of statements that problematise the toilet area.

Sections on animal welfare and antibiotic resistance have already shown that The Movement is more than comfortable with taking their discourses into the realm of *disgust* for support of their arguments against farming as natural. The terms faeces and faecal as well as pictures (see Figure 1 previously) are invoked for the affective use of *disgust*. Actors problematise milk by saying ‘when you milk a cow you are taking fluid that is literally swimming with bacteria yeast and literal faeces’ (Pandya, 2016). Valeti associates faecal contamination with meat, stating:

when we detach meat through slaughter...there is another big safety issue that your audience needs to know...whether the animal is raised in an intense farming operation or a grass pasture, at the time of slaughter there is contamination of the meat from faecal material (Harris, 2016).

The issue is framed by Datar as an inescapable association for meat eaters simply ‘because animals have guts with faecal matter in them’ (Dyen, 2016). The graphic at Figure 7 is used by Pandya (2016)

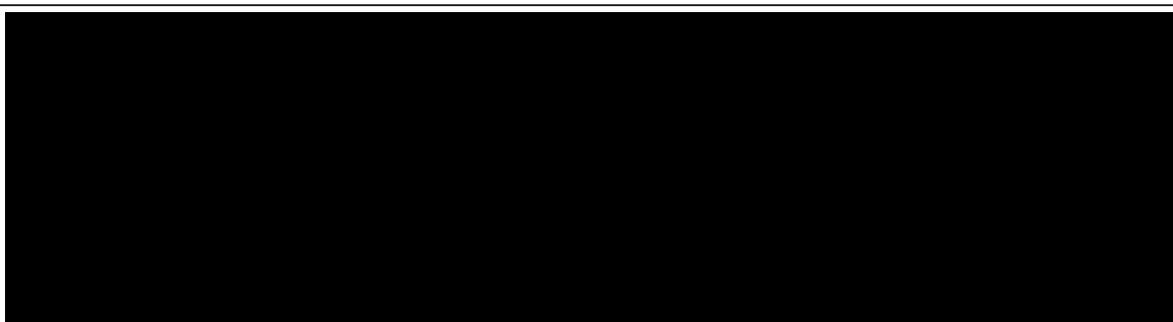


Figure 7. Pandya, R. (2016, March 16). *Developing the Animal-Free Future of Dairy* [Video File]. Retrieved from <https://www.youtube.com/watch?v=vv7gjWg5wTY>

to simultaneously problematise milk harvesting as a triple threat of disgust. Firstly, the cow not only eats grass but many other man made elements including ‘hormones’, an unnatural additive that elevates a farmed cow to something akin to a GMO. Secondly, the whole process is invasive to the

'1000lb sentient creature' thereby reinforcing the animal ethics narrative. Thirdly, this graphic highlights the fact that cows defecate, or as this graphic puts it, other than produce milk they elevate 'poop' production to the level of a 'machine'. The association of 'milk' and 'poop' being co-located at the geographic south of a cow, makes a discursive statement about the unnatural nature of milk as a food.

Disgust can be thought of using 'the principle of contagion' which says 'once in contact always in contact...the image of its origins is just too clear...but contamination is a necessity of life and we get through it by basically not thinking about it' (Rozin in Yu, 2012). The contention here is that faecal narratives by The Movement re-expose the origins of our food and then associate those origins with animal excrement. The revelation of food being exposed to faeces is a discourse that problematises the conception of farming as being natural by appealing to people's affective safety mechanism which we call 'disgust' and 'the principle of contagion accounts for many aspects of the reduction of naturalness, by contact with unnatural entities' (Rozin, 2005, p. 652). The Movement uses the disgust of eating faeces and contagion to bridge the discursive gap between unnatural farm and sanitised plate.

A prominent characteristic of the principle of contagion is that it is 'dose insensitive' and this means that a counter-argument from agriculturalists seeking to mitigate the damage of framing meat and milk as being contaminated by faeces, is unlikely. 'Dose insensitivity' is the belief that 'if something is harmful in large amounts, it is also harmful in small amounts' (Rozin, Ashmore, & Markwith, 1996, p. 438). Therefore, if the unnatural becomes a prominent characteristic in consumers' minds, then it doesn't matter how small the *unnatural* faecal amount is when associated with a previously conceived *natural* food, it is now contaminated and can no longer be thought of as natural. This immaterial contamination in people's minds is therefore more affective than the actual contamination of the material substance, which presumably has been known about for some time but has been able to be ignored through the enabling spatial disassociation between supermarket and slaughterhouse. The Movement's argument of faecal contamination is inoculated against counterargument, because to argue against the translation of meat and milk being contaminated by faeces, serves to *underline* the ontological association. This underlining could only serve to aid in the reproduction of the discourse that Animal Agriculture is unnatural and its products disgusting.

Concerning Human Health, The Movement uses narratives and images on the risks posed by Factory Farming to governmentally denaturalise farming. Trans-species Zoonotic diseases derived from

antibiotic resistance is a cause and effect argument from The Movement that problematises Factory Farming on a macro level. The Movement personalises the effect on individual human health and even the health of individual organs, by having credible actors adhered to the Assemblage, like Cardiologists, reproducing discourses on the hazard of overusing animal products. The 'Ick factor' is outlined in Chapter 5 as something The Movement also has to overcome, but here they reverse the role of 'Ick' and point it towards conventional Animal Agriculture through associating eating meat and milk with ingesting faecal matter. This deploys an affective weapon in 'disgust' which is both unable to be disassociated once contamination of the mind occurs and is undesirable to argue against because the affective contamination is dose intolerant.

4.5 The Superchicken Catchall

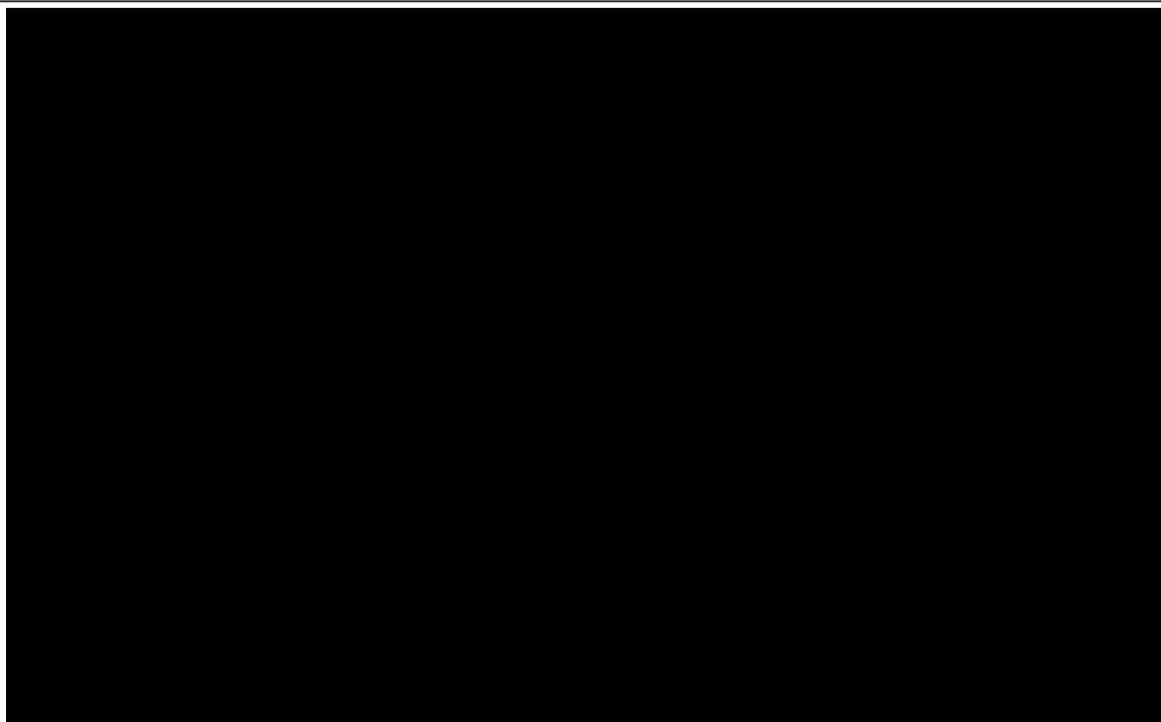


Figure 8. Datar, I. (2016d). *On Animal Products Without Animals* (The Status Quo). Retrieved from <https://www.youtube.com/watch?v=5FbQ89PFSsk&feature=youtu.be>

This graphical comparison in Figure 8 of what I have taken to calling *Superchicken* is one that summarises a number of critiques of farming as natural. The comparative breast of a young chicken in 2008 compared to an older 1950 version is used by Datar (2016d) to problematise not just chicken farming, but all farming when she says 'science has been used to create such intense outcomes'. This confluence of chickens representing all farming is an 'interchangeable logic that invokes a moral discourse' (Massumi, 2010, p. 56). To support this claim of *conflation* let's review some of the aforementioned statements from The Movement's actors. There is Pandya's (2016) critique of

farming's effect on greenhouse gases using the narrative of the 'guy who won't use planes but eats meat' thereby undoing all the moral good he accrues in reducing air miles. This story is based on *meat* consumption but is co-opted to support Pandya's promotion of Cow Free *Milk*. Similarly, Valeti uses the example of pig farming as a contributor to antibiotic resistance, in support of his product, the meatball made of cultured *beef* (Harris, 2016). Valeti uses chickens in the same way, but which has not yet been previously covered here, when he implores people to 'think about the chickens that grow 6-7 times faster than they would normally grow', once again a story about chickens is used as an example by a cultured *beef* scientist (Niu, 2016). This transference of narratives between types of animal farming is useful to The Movement in denaturing Animal Agriculture and is a discursive apparatus that can be used to problematise its practices. Those actors whose direct area of interest may not benefit from the logic, might referentially benefit from this unfixing of nature and Animal Agriculture. This manufacturing of conflation and interchangeability of logics are cultural devices and as such it is a key aspect of why this market making venture must be considered using a Cultural Economy approach.

4.6 Conclusion

In this chapter we started by examining how nature and culture had been split by highlighting some successive genealogical processes. The ideological work has been done over centuries where humanities dominion over nature has been warranted by the Gods. To exploit nature on an industrial scale in the 19th century, nature had to be formally zoned away into the periphery through governmental processes like town planning. This spatial disembedding imparted the necessary distance between slaughterhouse and supermarket to disconnect animal derived food from its origins. The Movement uses images of Factory Farming conditions, narratives of boys coming face to face with 'slaughtered' animals and the disciplined use of words like 'slaughter' to reconnect the animal welfare implications of conventional foods throughout the supply chain to denaturalise the process.

The Movement's reproduction of statements concerning Animal Agriculture's effect on the environment is outlined here in arguments about water, deforestation/land use and climate change. Notable here is the reproduction of discursive statistics produced by centres of calculation outside The Movement which are attached to the Assemblage for the purposes of bolstering the argument that Animal Agriculture is harmful to the 'commonwealth' of the ecosystem (Hardt & Negri, 2004). The importance of statistics is in their ability to invoke affect rather than their absolute accuracy. The final section is of how The Movement frames Animal Agriculture's effect on human health. From

the macro of zoonotic disease enabled by antibiotic resistance to the micro of individual human health concerns from ingesting too much animal product, The Movement destabilises Animal Agriculture as natural. The associating of meat and milk with contamination by faeces is the affective argument which arguably black boxes this denaturalisation better than any other and uses the 'ick' factor against the status quo in preparation for arguments against the 'ickiness' of Synthetic Foods.

The argument here is that actors within the Synthetic Foods Assemblage, use critical devices as artillery to batter down Animal Agriculture's 'frames' and create visible 'overflows' on one discursive front (Callon, 1998). In tandem, other social, political and economic actors of the Assemblage, wield enacted knowledges to arm and mobilise a second discursive front that redefines the symbolic meanings of Animal Agriculture under a new 'signifying system' (Nimmo, 2010, p. 16). These battle lines are drawn against a new enemy, 'Factory Farming', a name that resonates on the affective register of potential actants that might enrol in the Assemblage, to become adhered to The Movement, without forcing those actants to confront their identities as having been forged from hard working, land clearing, pioneers of pastoral farming. Both fronts, if diffused widely enough, could influence political actors to mobilise support in a different direction than is currently the tentative status quo enjoyed by Animal Agriculture.

In using the discursive apparatuses shown here, The Movement asks society to 'requalify' conventional animal food products, to scrutinise its identity and therefore 'to question their own social identity' (Callon et al., 2003, p. 74). If enough actors accept the redefined identity of 'Factory Farming' (which as demonstrated here is just Animal Agriculture with a more evil name) as offered by The Movement, then Animal Agriculture must pass new 'cultural tests of felicity' (Callon, 2007, p. 326). The Movement is using discourse to create a 'new spatial imaginery...a green governmentality or environmentality' in a new topological ordering that blurs the spatial line between the urban/rural, and nature/culture binaries (Murdoch, 2005, p. 150). The overflows produced in one binary hemisphere, can no longer be contained in the spatial periphery or banished to the comfortable immaterial periphery of the mind. This topology blurs a second, temporal line, where the ecological resources inherited by future generations are problematised and this affective threat mobilises pre-emptive action in the present when consumers become aware 'of the smoke from future fires' (Massumi, 2010, p. 63). Discourse is directed towards governing the human actors in the network but does not account for the agency of non-humans. We move now to Assemblages in order to assist Discourse in explaining the topological spaces of how Synthetic Foods is being constructed and framed, among the rubble of the destabilised frames of Animal Agriculture.

Chapter 5 – Assembling a Market for ‘Natural’ Synthetic Foods

In ‘becoming’ a market, the Synthetic Foods Assemblage must stabilise a series of ‘heterogeneous multiplicities’ through discursive events (Harvey, Hardt, & Negri, 2009; Woodward et al., 2009, p. 294). Chapter 4 highlighted the way in which discourse ‘problematized’ Animal Agriculture as being unnatural and therefore problematized the legitimacy of the nature/culture binary. In this chapter it is explained how the Assemblage proceeds with the work of stabilising its own relations through various negotiation phases of ‘translation’ (Callon, 1986, p. 202). This is not to say that The Movement is moving through these phases of translation in a uniform and calculated way as that would imply there is a center of control that directs the actions of each actor, where it is more useful to see the Assemblage envisioned here in terms of what Deleuze described as a ‘garden rather than a tree’, as an agglomeration of intersecting and conflicting bodies (Tampio, 2009, p. 385). Various actors at various times are actualising their ideals in multifarious ways which constitute statements for stabilising the identity of actors so that they submit to integration in the Assemblage and become part of The Movement.

The Movement creates discourses, practices and aesthetic relations that ‘constitute economically relevant objects’ for assailing Animal Agriculture (Law, 2002 as cited in Woodward, 2005, p. 333). In a similar way, Climate Change became activated when a Scientific Assemblage extended to include political rationalities. This problem space was creatively reduced, giving rise to a series of smaller solvable problems addressed through new devices such as carbon taxes (Callon and Latour both cited in Blok, 2014, p. 8). The Movement offers solutions to the problems relating to animal derived food production in a similar way and communicates them through statements and events which normalise the practices of creating Synthetic Food.

This normalisation is directed towards humans, a cultural target that must be enrolled into the Assemblage for stabilisation of a market to occur. Statements are used to pre-empt any objection to Synthetic Foods being normal. The Movement must overcome its own version of the ‘ick factor’, where a mistrust of foods created in a lab is a potentially major objection working against the technologies diffusion among consumers (as described in Mattick, Wetmore & Allenby, 2015; Tucker, 2014). What will be shown is that The Movement uses various discursive mechanisms so that enrolling in the network might seem less ‘icky’. If economies can be thought of as ‘discursive constructs that are performed or enacted by discourses’ and that ‘in advanced economies, cultural meaning increasingly plays a part’ (McDowell, 2002, p. 690), then here it is shown that Cultured

Meat and Milk combined with the promotional charity *New Harvest* use discursive statements to enact scale in a way that shows Synthetic Foods as *inevitably* becoming an ontological reality.

In The Movement's treatment of non-human actors, there are many simplifications that are offered to represent them as already stably translated into the Assemblage. But speaking on behalf of the non-human is treacherous and the difficulties of such simplification is the theme that will round out this chapter. Whether the problematisation of Animal Agriculture will be enough to adhere actors onto the solutions provided by The Movement's Assemblage in the same manner as 'problematising Communism galvanised western populations into winning the cold war', remains uncertain (Curtis, 2006). The Movement therefore uses discursive devices to construct a new Assemblage. The alternative of Synthetic Foods is offered as far superior to the status quo and creatively works in opposition to the discourses that have split culture from nature.

5.1 Overcoming 'ick'

'To interest other actors is to build devices which can be placed between them and all other entities who want to define their identities otherwise' (Callon, 1986, p. 204). The Movement frames the identity of Synthetic Foods and emplaces it in spaces where they can 'engage the public very early by talking about technology that is 5 to 10 years out; just to be there as an avenue for consumers to get involved is very relevant' (Datar, 2016e). Simply engaging a public in a new innovation may not be enough to disrupt people's conception of an 'existing product that is deeply entrenched in their identity, culture or customs' because 'it's the loss they are afraid of, not the newness, so people react intuitively and then collect the evidence to support what they're doing' (Juma cited in Overly, 2016). For Synthetic Foods this intuitive reaction can be explained using the same description of discourse that The Movement uses to associate faeces with Animal Agriculture, namely the 'ick factor'.

In a series of focus groups which obtained consumer reaction to 'in-vitro meat' among other 'non-conventional proteins', the reactions of most participants were negative, 'it creeps me out', 'it's not normal', 'it's artificial' and 'it's an insult to meat' were among some of the verbatim reactions to the coloured handouts and researcher explanations of this practice (Tucker, 2014, p. 174). Perhaps the study being conducted in a highly geared primary production economy like NZ skewed the results and the researchers admit that as a likelihood, but the results are similar to an electronic article from the Canadian Press on Cultured Meat featuring eight comments from readers at the bottom. Only

one comment is positive, the other seven comments range from mistrust, to disbelief and also disgust at innovating a 'Frankenfood' (Sagan, 2016).

The 'ick factor' seems to be a major obstacle for The Movement to overcome in attracting actors to support The Movement's promise of material products. Therefore The Movement pre-emptively argues against the 'ick factor' so, assuming products become available, consumers are more likely to see that Synthetic Foods are 'something that tastes as good or better, often cheaper, and are more sustainable and healthier' (Pullar-Strecker, 2016). What follows are an analysis of some ways that The Movement pre-emptively contests the view that their material constructions are 'icky'. First the actants themselves are framed as young, smart and sexy and therefore Synthetic Foods are relationally *cool*. Next the relational association between Synthetic Foods and its celebrity investors, evokes a discourse of *inevitable* becoming. Then the simplification of Synthetic Food practices through imagescapes and the disciplined use of naming shows how The Movement *normalises* their practices. Finally, it will be shown how the Assemblages identity is defined by outlining what it is not, namely, it is the *antithesis* of and an improvement on, Animal Agriculture's unnatural way of producing food.

5.1.1 Young, Smart, Sexy and Cool Actants

The reaction of 'ick' that is embodied in people's affective register when thinking about lab grown food, can be seen as the bodies way of alerting us to a potential threat. Rozin uses the metaphor of 'Hitler's sweater' to describe how this affective reaction of disgust can be changed in people's minds. 'The only way you can get people to wear Hitler's sweater, is to first dress someone like Mother Theresa or Michael Jordan in it, so that their spirit can go in and conquer Hitler's evil spirit'. So the act of putting something 'icky' next to something magnificent is a performance of affective cleansing (Rozin in Yu, 2012).

In Figure 9 are images of some of the prominent actors of The Movement taken from various digital media. A subjective observation might be made about the youthfulness and physical attractiveness of these actors. Glencross (top left) is a professional model 'when a really cool brief comes up' as well as being a New Harvest Research Fellow and Chemical Engineer designing Cultured Meat bioreactors at King's College London (New Harvest, 2016a). The association of modelling and Cultured Meat through the identity of a beautiful and smart young woman embodies The Movement's cool, sexy and smart veneer.

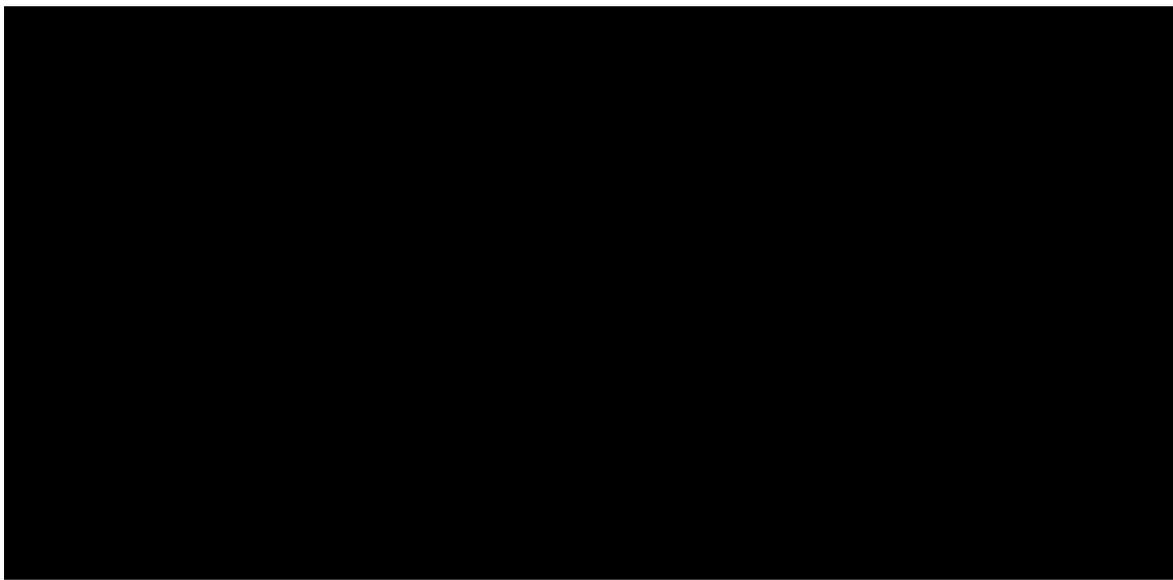


Figure 9. Mouat, M. (2016, November 24). *How a Market for Synthetic Foods is Being Assembled*. Paper presented at The Dynamics of Economic Spaces Commission Meeting, Palmerston North, New Zealand.

From Top Left in a clockwise direction:

[Untitled image of Abi Glencross]. Retrieved from <http://www.futurefarmlab.com/>

[Untitled image of Gilonne d'Origny]. Retrieved from <http://www.new-harvest.org/about>

[Untitled image of Dr. Marianne Ellis]. Retrieved from <http://www.bath.ac.uk/chem-eng/people/ellis/index.html%20>

[Untitled image of Erin Kim]. Retrieved from <http://www.new-harvest.org/about>

[Untitled image of Uma Valeti]. Retrieved from <https://commonreader.wustl.edu/memphis-meats/>

[Untitled image of Daan Luining]. Retrieved from <http://www.new-harvest.org/about>

[Untitled image of Arturo Elizondo]. Retrieved from <http://www.new-harvest.org/about>

[Untitled image of Ryan Pandya]. Retrieved from <https://www.youtube.com/watch?v=vv7gjWg5wTY>

[Untitled image of Isha Datar]. Retrieved from <https://foodtechconnect.com/2016/04/11/cellular-agriculture-is-the-next-revolution-in-food/>

[Untitled image of Natalie Rubio]. Retrieved from <http://www.new-harvest.org/about>

Valeti (top right) worked as a Cardiologist in the U.S., which he mentions to explain how he came to have an interest in growing muscle cells (Harris, 2016). 'Valeti also researched stem cells for regenerating cardiac muscle in heart attack victims' (Burmingham, 2016). These statements can be read as narratives about a constructed identity that gives Valeti's company Memphis Meats, some notion of referred credibility in a way that works to normalise The Movement as containing actors who are professionally credible, intellectually aspirational and guardians of human health. Datar (2nd from bottom left) is the CEO of *New Harvest* holding a MSc in Biotechnology from the University of Toronto with published work in *The Journal of Innovative Food Science and Emerging Technologies* (Datar & Betti, 2010; New Harvest, 2016c). Her website profile affords her the credibility and intellectual attractiveness to match her physical attractiveness, but where she differs from Glencross and Valeti is in the prolific production of her media communications in promoting the Synthetic Foods Assemblage as a whole. Datar (2016e) says that:

We [New Harvest] also have a unique perspective when it comes to innovators, because our community is made up of scientists who want to get involved in this field as well as entrepreneurs and investors... they are interested because they are consumers too but also because they are interested in ground breaking science and doing things that hasn't been done before (Datar, 2016d).

In this statement, she speaks on behalf of the entire Assemblage and associates credible 'scientists' with aspirational 'entrepreneurs and investors' that are enrolled in the culturally economic occupation of 'ground breaking.' These three examples of actors are offered as subjective evidence in the argument that The Movement portrays an identity for itself as being young, sexy, cool and credible. The self-identity of The Movement is 'accelerated through the actors expert knowledges' and these knowledges are embodied in sexy, young, cool and smart packages which are better than normal and therefore the opposite of 'icky'. A potential consumer of Synthetic Foods can imagine for themselves belonging to a group such as constituted here, by enrolling in the Assemblage, 'identity formation can occur and one can be, become and belong in place' (Mansvelt, 2005, p. 80).

5.1.2 Celebrity Investors

The associational links between The Movement and high profile investors constructs a social identity of an as yet unrealised but *inevitably* successful Assemblage that may overcome the 'ickiness' of lab grown food. The 'values' provided by The Movement and the 'value' provided by investors 'connects the economic with its other' to normalise Synthetic Foods as a solution to the problems posed in Chapter 4 (Miller, 2008, p.1128). The important 'performative moment' embodied by Mark Post's \$330,000 USD Cultured Hamburger revealed that Google co-founder Sergei Brin was the previously unknown benefactor of the entire \$330,000. The event began to be translated for the public when Brin expressed himself as 'not comfortable' with intensive farming and numerous other actants defined the problem to be solved in a series of interviews prior to the taste test (Cultured Beef, 2013). Post commented on the strategy suggested by Brin for making a 'burger rather than a sausage so as to appeal to American audiences' (O'Riordan et al., 2016, p. 6). The live studio audience acted 'as evidence for the significance of the burger' and the entire event could be argued as giving the 'promotional public' an opportunity to familiarise themselves with Cultured Meat (O'Riordan et al., 2016, p. 2).

Li -Ka Shing was listed as the world's 20th richest man in 2014, just one below Brin (Brown, 2014). This same year his venture capital firm, Horizons Ventures, invited the Milk Without Cows entrepreneurs of Muufri to meet in their Hong Kong offices. Soon after it was announced that

Horizons Ventures would provide \$2 million as seed money for a proof of concept and that Muufri would move to San Francisco in order to obtain laboratory space and hire scientists (Datar, 2015). Horizons has also provided seed money to start-ups within The Movement such as *Modern Meadow*, which seeks to produce lab grown leather to disrupt the \$90 billion a year leather goods market and *Impossible Foods* which seeks to provide an algae grown alternative to conventional beef as well as other non-assemblage entities such as *Spotify* which although not food related, arguably adds to the credibility of the Assemblage by being mentioned alongside them as portfolio team members (Horizons Ventures, 2016). *Impossible Foods* also has the associational advantage of another well-known celebrity investor, the world's richest man in 2014, Bill Gates (*The Economist*, 2016). The next celebrity investor to introduce is also the newest.



Figure 10. Datar, I. (2016f, July 26). *This Space Tourist is a Cultured Meat Philanthropist* [Twitter moment]. Retrieved from <https://medium.com/@NewHarvestOrg/this-space-tourist-is-a-cultured-meat-philanthropist-e00151d0c7df#.hscskj4xj>

Mark Shuttleworth, depicted in Figure 10, is an internet entrepreneur and 'space tourist' whose Shuttleworth Foundation funds intellectual property free endeavours. The Foundation has agreed to fund New Harvest in a way that is historically significant for the organisation (Datar, 2016f). Sticking with the Space Explorer theme, organisations that have reached celebrity status such as NASA, has been at the forefront of human achievement for decades and continues to inspire technological fascination by planning interplanetary missions to planets such as Mars.

Cultured Meat gained its original notoriety by being researched as a possible way to feed astronauts in long interplanetary space missions (Pandurangan & Kim, 2015). Shuttleworth's and NASA's involvement in the genesis of Synthetic Foods adds an associational credibility to the technology.

Having Brin, Ka-Shing, Gates, Shuttleworth and NASA associated with projects of the Assemblage, normalises the technology. The relational associations between the 'values' of activist scientists and the 'value' provided through the financial support of celebrity investors means that the materiality of future Synthetic Foods becomes more than just normal. While financial value is no doubt helpful in the early stages of actants seeking to scale their products, the argument here is that their association makes the technology performatively *inevitable* because investment centres of

calculation with this pedigree are presumed to be of the 'knowing class', as in Bourdieu's (1984) class based system of 'distinction'. The referential expertise of those with an entrepreneurial track record of performing world changing technologies into existence, warrants Synthetic Foods as valid or even aspirational when 'value is produced out of virtualism' in the same way as 'CEOs become a kind of celebrity capital in the quest for shareholder value' (Miller, 2008, p. 1125). The heterogeneous associations between actors of the Synthetic Foods Assemblage which includes celebrity investors, makes the materials of The Movement less 'icky' in that they close the topological space between the already enrolled celebrity actors and the yet-to-be enrolled potentiality of 'knowing' consumers that can imagine for themselves having like-minded entrepreneurial identities and values (Mansvelt, 2005, p. 89).

5.1.3 Simplification

The sexy, cool, young, smart actors and the celebrity investors with their celebrity organisations can only take the discursive battle against 'ickiness' so far, as they only indirectly confront the threat of 'ick'. The preconceptions that work against the naturalness of material food grown in a lab must also

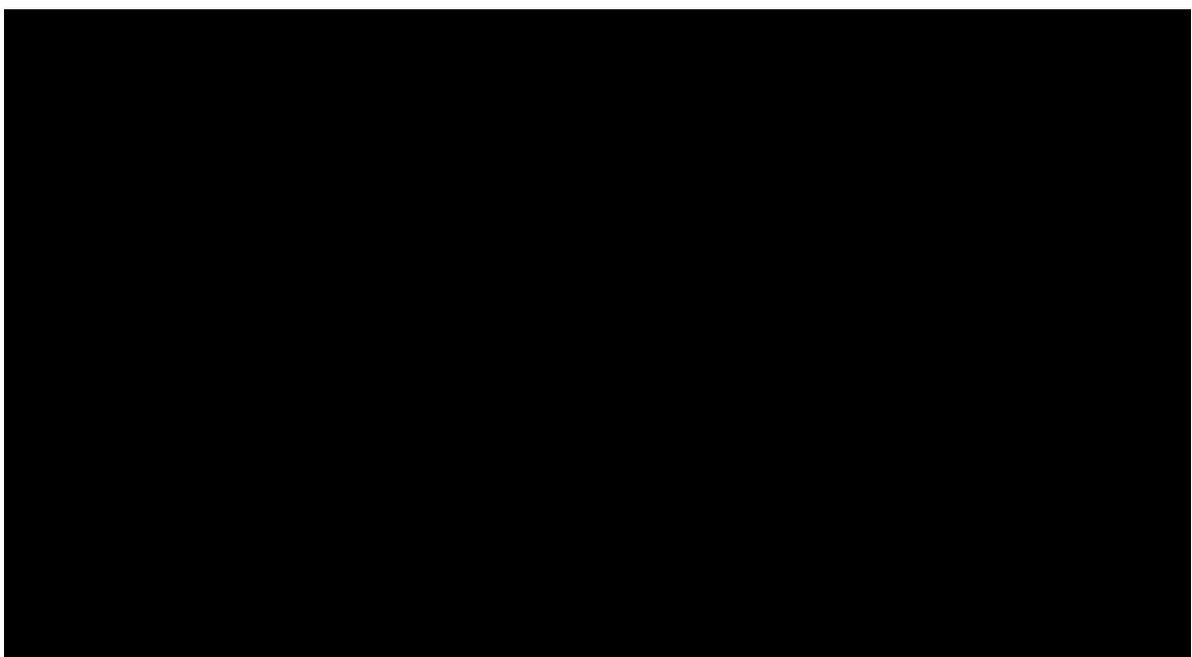


Figure 11. Pandya, R. (2016, March 16). *Developing the Animal-Free Future of Dairy* [Video File]. Retrieved from <https://www.youtube.com/watch?v=vv7gjWg5wTY>

be negotiated. This is the work of images that simplify the process of manufacturing familiar products like milk and beef and also 'the Brewery narrative that has taken over from the Space exploration narrative that persisted in the early 2000's' (O'Riordan et al., 2016).

Pandya (2016) says to a conference audience when referring to the image at Figure 11:

There's no way I would choose a 1000Lb animal for this process [making milk], if you want a metabolic process the best way to do that it is to do it in a tiny machine that is optimised for doing metabolic processing and that's a cell...and we're doing it in a better way and that's called a bioreactor (Pandya, 2016).

The cow is represented complete with the destabilising narratives from human health arguments of Figure 7 in Chapter 4, with 'feed contaminants' going in and 'faecal contamination' coming out. This is contrasted with a bioreactor as used in the socially acceptable process for making beer, but not just normal commercialised beer, this process is analogous to 'craft beer' as the title suggests.

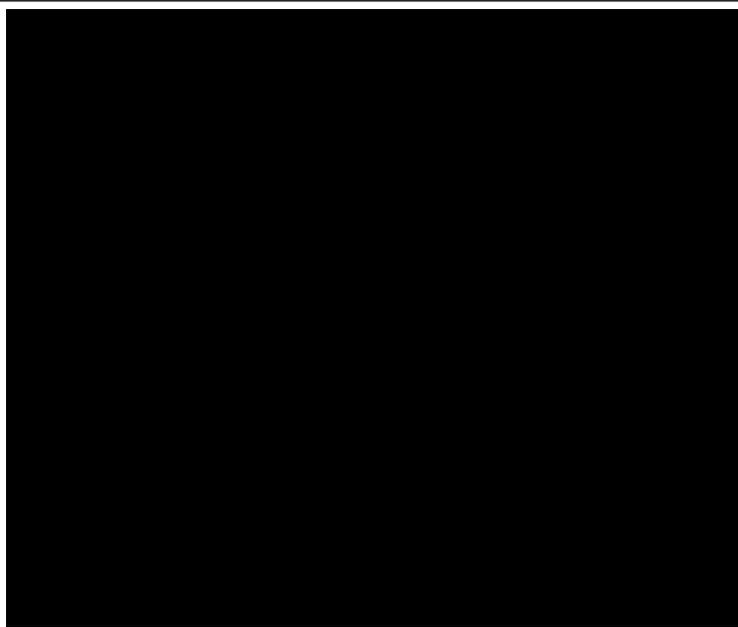


Figure 12. Datar, I. (2016d, February 29). *On Animal Products Without Animals* [Video File]. Retrieved from <https://www.youtube.com/watch?v=5FbQ89PFSsk&feature=youtu.be>

Milk made conventionally is contrasted by Datar (2016d, and reproduced in Richardson, 2016) using Figure 12, where 'you have to artificially inseminate a cow, keep them in a lactating state for the entire time that they produce milk, and deal with all the contamination problems associated with getting milk from mother cows', cows being 'mothers' reinforces the disassembling narrative of Animal Agriculture being cruel to animals and therefore unnatural. In

addition, the process is represented as a slide in a downward trajectory, perhaps foreshadowing to the audience the inevitable future of milk from animals. Compared then to the process of fermenting Milk Without Cows, represented on the upward trajectory denoting emergence, where 'the way we want to make milk is to use a yeast that has been designed to make milk proteins, grow it up in a brewery type scenario and have milk at the end' (Datar, 2016d). This simplification is just a two-step process in contrast to the conventional three-step, so presumably this representation means Synthetic Milk is at least one third more efficient. The culmination of both processes ends with the image of milk in a glass that denotes the promise of Synthetic Milk being the *exact same* ontological product. This familiar form helps to make Synthetic Milk normal and therefore less 'icky'.



Figure 13. Datar, I. (2016d, February 29). *On Animal Products Without Animals* [Video File]. Retrieved from <https://www.youtube.com/watch?v=5FbQ89PFSsk&feature=youtu.be>

The process for producing Cultured Meat is dealt with in a similar fashion. Here in Figure 13 the simplification of turning a biopsy from a cow into a hamburger, is used to frame how actors would 'grow those cells up in a *sterile* condition and then have the exact same burger that we're familiar with' (Datar, 2016d). The notion of sterility is repeated in other statements when

Datar says that she 'think(s) if making meat looked more like brewing beer, we'd have more sterile, clean environments' (Dyen, 2016) and so the 'Carnery' (A brewery that brews meat) is therefore more natural (Mattick, Wetmore & Allenby, 2015, p. 63). The sterile conditions where a biopsy is obtained are in this image represented *without* the shadowy long armed humanoid violating the cow from behind, which is treating violation differently to the image at Figure 12. The end result of a familiar hamburger that pops out of a simplified bioreactor creatively frames the product as ontologically the same as conventional beef and like the glass of milk in the figure prior, makes Cultured Meat more normal and less 'icky'.

The brewery narrative is bolstered through an image of an actual brewery outside of Boston shown at Figure 14 on the following page, using this image Datar (2016d) explains:

Our thinking is, what if the farm looked like this, this is a beer farm...in these huge stainless steel tanks, you have food being transformed by living cell cultures, they're taking carbohydrates in and they're transforming it into beer...these are very safe, sterile conditions and the people that work here we perceive as artisans and craftspeople and they're microbiologists who are monitoring these cultures and making sure that everything is happening as it should (Datar, 2016d).

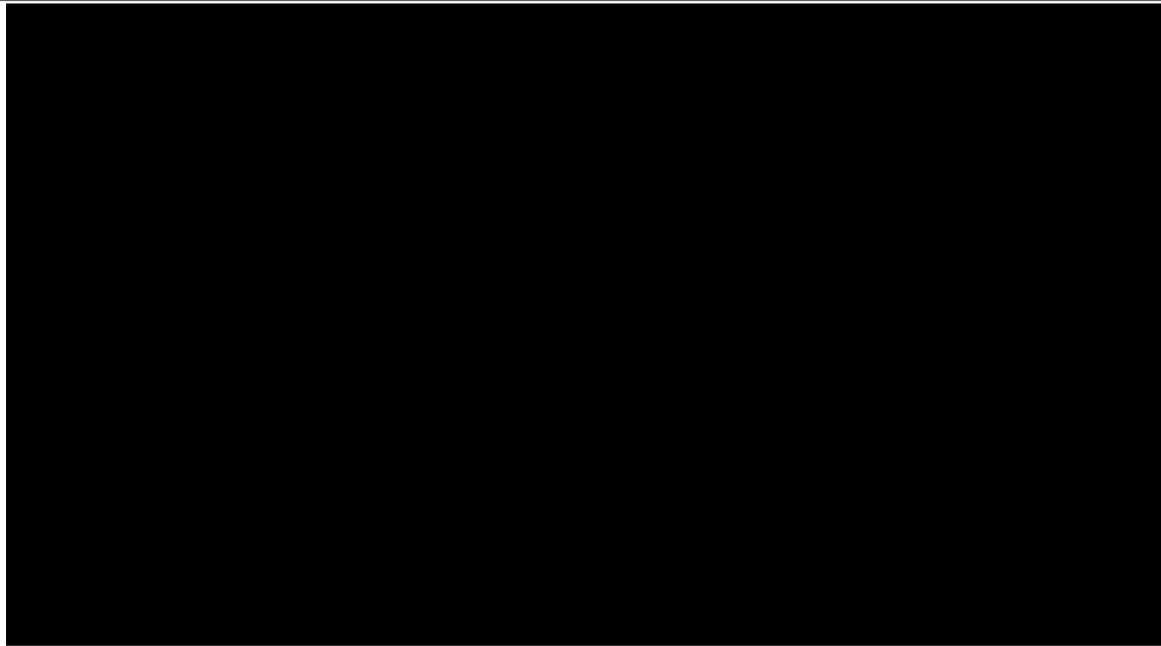


Figure 14. Datar, I. (2016d, February 29). *On Animal Products Without Animals* (What if this was the farm?) [Video File]. Retrieved from <https://www.youtube.com/watch?v=5FbQ89PFsSk&feature=youtu.be>

This 'beer farm' is normalised not only through the material artefacts of familiar biotechnology processes but also through the people that cannot be seen, the brewers who are both 'artisans' and 'microbiologists'. The association is clear, the scientific actors of the network producing food through Cellular Agriculture are therefore artisans by association. Other actors are employed in this photo, being the brewery tourists taking photos of beer bioreactors, where the process of using biotechnology by artisan microbiologists is worthy of paying to view and take photos of. This visitation shown pictorially, is part of a disciplined narrative common to various actors of The Movement. For example, Valeti explains on behalf of Cultured Meat, that 'when we are manufacturing...the public can visit all our manufacturing plants' (Harris, 2016) and Erin Kim offers that 'breweries are these wonderful places where people go on tours, do tastings and things are produced in this artisanal manor' (Holowack, 2016). Valeti makes this offer again at the Indiebio Open Day 2016 when he 'asked consumers whether they'd rather visit a slaughterhouse or see how Memphis Meats makes their food in a *clean lab*' (Niu, 2016). 'The School Trip' is a similar visitation narrative found in academic texts that advocates for Cultured Meat. Here the authors invoke an imaginary school trip from the future, where a 'director' of the city's fictitious 'Meat Production Facility' explains to young children the grim reality of how meat *was* produced in 'slaughterhouses' before science solved the unnatural problem (Welin, Gold, & Berlin, 2012, pp. 294-295).

The 'imagescapes' used by actors denote a promissory narrative of what Cow Free Milk and Cultured Meat can be, it is distinct but complimentary to other texts in that it invites the reader to 'co-create'

a 'wow' factor that overcomes the potential 'ick' factor response (Stephens & Ruivenkamp, 2016, p. 348). The brewery narrative is a simplified associational discourse used by actors which locates food made in a lab alongside the socially acceptable process of brewing beer. The choice of using fermentation in a brewery as the associational narrative could just as well have been sourdough bread, chocolate or yoghurt. But like the cool, sexy and youthful images of the actors themselves and the aspirational associations of celebrity investors, breweries could be seen as centres of cultural coolness that add to the communicative strategy which seeks to make Synthetic Foods *natural* and therefore not *icky*.

5.1.4 Naming

The narratives, storytelling and imagescapes produced within The Movement which are shared by its multifarious actors, is attestation to their heterogeneous relational associations. Another variant of the disciplined negotiations that binds this network together are the commonly used descriptive *names* that actants adopt when portraying their discursive messages. Offered here are four examples of names that both construct associational *familiarity* which works against the *ick* factor and simultaneously transmits *progress* that promotes the *wow* factor. The names outlined here are 'Cellular Agriculture', 'Cultured Meat', 'Milk Without Cows' and 'the Post-Animal Bioeconomy'.

The term 'Cellular Agriculture' is used 24 times on the New Harvest 'Mission and Vision' webpage alone (New Harvest, 2016b). Erin Kim explains that 'we coined the term Cellular Agriculture to describe the various methods used to produce these products, because that's really what it is, farming and harvesting different materials and food products, but at the cell level' (Holowack, 2016). The collective noun of 'we' is used by Datar (2016e) also, when she says that:

We use cellular agriculture which looks more like this [shows the Brewery at Figure 14] than large scale industrial factory farming... a process that is more sustainable, efficient and more predictable when it comes to changes in weather or disease outbreaks (Datar, 2016d).

In these two statements from within New Harvest, 'Cellular Agriculture' is still 'farming' but unlike 'Industrial Factory Farming' it is more resilient to the parts of nature that disrupt food production.

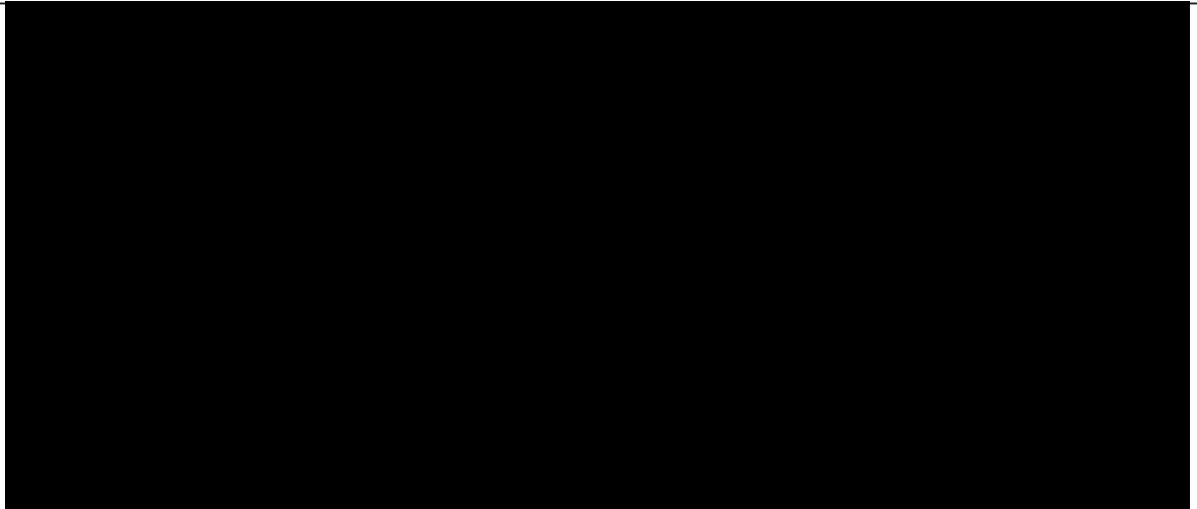


Figure 15. Datar, I. (2016e, June 27). [Presentation to the National Academy of Sciences, Engineering and Medicine] [Video File]. Paper presented at the 3rd Public Meeting on the Future of Biotechnology Products and Opportunities to Enhance Capabilities of the Biotechnology Regulatory System. Washington, DC. Retrieved from <https://vimeo.com/173649708>

In Figure 15 we see another graphic that rationalises the term as being a product of two 'sciences', both 'medical' and 'food' although in the explanation that accompanies the image on the New Harvest website, the narrative admonishes these two sciences because 'neither have taken ownership of Cellular Agriculture which is why New Harvest is the sole group advancing this work' (New Harvest, 2016b). The words 'cellular' and 'agriculture' are both well-known signifiers in normal lexicon and so by combining them together, the sign of 'Cellular Agriculture' assists to normalise the practice.

Although 'Cellular Agriculture' here is claimed to have spawned from 'medical science', only 'Cultured Meat' can really claim this discursive ground with any certainty. 'Cultured Meat' is a replacement name for what was the more commonly used terms of 'In-Vitro Meat' or 'Lab Grown Meat' or as it is sometimes derisively referred to as 'Frankenmeat'. Kim laments that 'these terms are a source of a lot of the 'Yuk factor' and it 'doesn't help to add anything to the discussion' therefore 'Cultured Meat is the most scientifically accurate term, it's the one that *New Harvest* are advocating to become the standard' (Holowack, 2016). This message has been subverted by academics critical of this technology with one calling it 'Shmeat', an unholy alliance of shit and meat that redirects The Movement's argument for associating faeces with Animal Agriculture (Metcalf,

2013). Of Mark Post's Cultured Hamburger tasting event O'Riordan et, al. (2016, p.7) noted the absence of the term 'In-Vitro Meat' with preference given to just 'Meat', first defining it as 'meat is muscle' and then defining Cultured Beef as 'meat just not in a cow'. Although 'Cultured Meat' is a disciplined name used by numerous actors, irrespective of their specialty product (See Pandya, 2015, Pandya, 2016, Valeti, 2016, Post et al., 2016) there is at least one example of an actor with sufficient cultural capital within The Movement that can advise of another name being acceptable. Datar (2016c) tweeted permission to use an alternative name for Cultured Meat stating 'you can now refer to the cell cultured hamburger as Meaty McMeatface' in deference to the media phenomenon of 'Boaty McBoatface' which subversively topped a public British vote for naming a new Antarctic Research Vessel. Datar being young and cool is well qualified to appropriate social media phenomena for advancing the ends of The Movement.

When Pandya delivered his five-minute pitch to win €200,000 at the 2015 Green Challenge, he began and ended by referring to Muufri's product as 'Milk Without Cows' (Pandya, 2015).

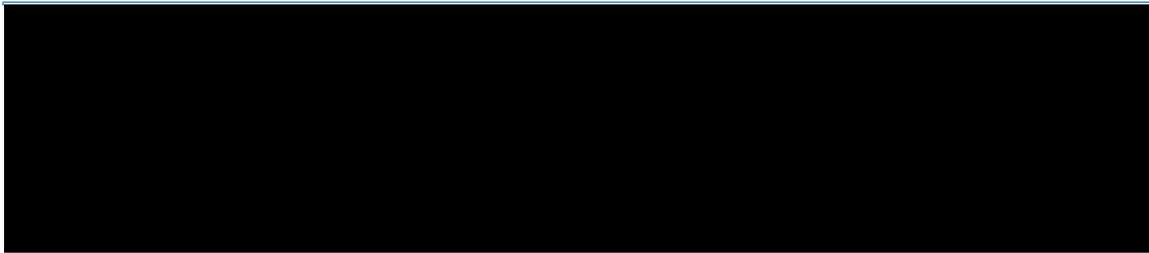


Figure 16. Pandya, R. (2016, March 16). *Developing the Animal-Free Future of Dairy* [Video File]. Retrieved from <https://www.youtube.com/watch?v=vv7gjWg5wTY>

In Figure 16 is a slide from a later presentation, where he made this association clear (Pandya, 2016). Perhaps because there has been less written about Synthetic Milk or because the technology for fermenting milk is said to be newer, there hasn't been the development of alternative names. Muufri have perhaps taken the lessons learned by 'Cultured Meat' and proactively named their technology so as to control the discursive statements produced on its behalf.

Both 'Cultured Meat' and 'Milk Without Cows' along with other products represented by actors of The Movement are grouped under the umbrella name of 'the Post-Animal Bioeconomy'. When actors of New Harvest talk about the Post-Animal Bioeconomy, they use it to describe a future that looks back on a now irrelevant past and portrays the becoming of a more relevant future. The present as represented by The Movement through the signifier 'Post-Animal Bioeconomy', portrays the notion of an impending dawn, where 'a new industry, of animal products made without animals' is inevitably approaching, with economic consequences (Holowack, 2016). The Post-Animal

Bioeconomy is said to have an ontological existence in the here-and-now which bridges the gap between immaterial promissory narratives and the materialisation of products. This phrase signifies a *becoming*, where after a 'strong scientific foundation exists...the Post-Animal Bioeconomy can *become* a thriving industry...with options catering for consumer choice' and Datar (2016a) is said to quote Valeti in saying 'we need to have about 1000 Cultured Meat companies in the world' (Datar, 2016a). The Post-Animal Bioeconomy is an imagined structure enabled through synthetic biology but diffused through what is hoped to be a growing cultural need to help construct a new Assemblage that makes Factory Farming obsolete and re-associates culture with nature in a new way.

The names given to various aspects of the Synthetic Foods Assemblage indicates a binding of relations between its actors. The disciplined and repeated phrases of 'Cellular Agriculture', 'Cultured Meat', 'Milk Without Cows' and the 'Post-Animal Bioeconomy' construct the discursive frames that describe what Synthetic Foods are and what they can do. These walls are social constructions that 'reinforce the social identity' of The Movement and normalises their practices through combining already socialised signifiers (Garcia-Parpet, 2007, pp. 41-45). When things become normal they become less *icky*.

5.1.5 The Antithesis of Animal Agriculture is Normal

The Movement attempts to overcome any predisposition to the 'ickiness' of lab made foods, by framing itself as being a vast improvement on unnatural Animal Agriculture, an artefact that has thrived due to the nature/culture dualism. The arguments given for what Animal Agriculture really is thereby defines what The Movement really is, by highlighting what it is not. When it is explained how Cellular Agriculture is the *natural* antidote for an *unnatural* set of practices, it is therefore not *icky*. Better for animals, better for the environment and better for human health are three ways in which The Movement self identifies its own practices, as an improvement on the negative consequences of Factory Farming by orders of magnitude.

Factory Farming is framed as being cruel to animals, which is an ethical argument that generates 'most of our [The Movement's] support' according to Kim (Holowack, 2016). The Assemblage is enmeshed with relational associations between The Movement's actors and animal welfare groups. For example, @muufri follows a number of other twitter users including animal welfare organisations and ethicists such as '@happycow' and '@vegansaurus' (Muufri, 2016). Datar says that 'it would be incredible to be able to have these familiar products without knowing that *slaughter* was involved, without knowing that these animals were raised in very difficult scenarios...where animals are overfed, overworked and overbred to the point of sickness or death', in other words lab-

grown products offer an ‘arresting alternative’ to practices that are cruel to animals, a move away from ickiness as they are the antithesis of Animal Agriculture (Richardson, 2016).

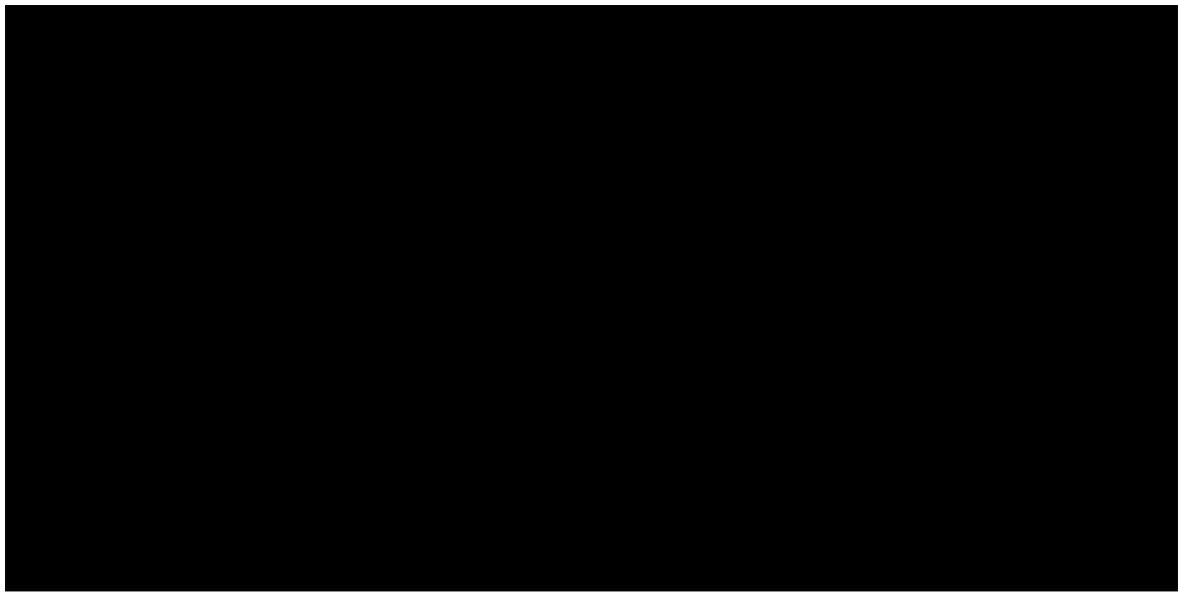


Figure 17. Pandya, R. (2015, September 21). *Green Challenge 2015: Pitch by runner-up Ryan Pandya. Muufri* [Video File]. Retrieved from <https://www.youtube.com/watch?v=ThJRUFp8vzM>

Pandya (2015) outlines how Synthetic Milk is a vast improvement on ‘farmed milk’ by displaying the graphic at Figure 17 and quoting from the statistics, offered in a descending order of relational magnitude and presumably presented using only the upper limit of the ranges offered by Tuomisto & Teixeira De Matto’s (2011) paper titled *Environmental impacts of cultured meat production*. Pandya (2015) presents the alternative as a solution where ‘we are brewing milk and the potential impact is gigantic’. Using calculative framing to define how much better ‘brewed milk’ is than ‘farmed milk’ and using statistics which describe the improvement, makes a concurrent statement about the ickiness of farmed milk and also the comparative medicine for ickiness, namely brewed milk.

In relation to human health there are advantages expressed in synthetic products compared to animal products. The image at Figure 18 on the next page, represents the results of a Memphis Meats ‘science’ experiment as recounted by Datar (2016d), where:

they swabbed their meatball then went to a grocer, found conventional meat then found organic meat that was raised without antibiotics and swabbed that, and looked for what bacteria was growing on those samples. So as you can see cultured beef and cultured pork are a lot safer in terms of microbial contamination (Datar, 2016d).



Figure 18. Datar, I. (2016d, February 29). *On Animal Products Without Animals* [Video File]. Retrieved from <https://www.youtube.com/watch?v=5FbQ89PFSsk&feature=youtu.be>

One might struggle to see how this simplified slide would make its way into a deck being presented to a different audience such as the scientific academy as it has no comparative data, but it may be enough to interest consumers, who can then go and re-reproduce the narrative of Cultured Meat's comparative cleanliness to conventional and organic meat. This 'science experiment' is supported by academic narratives, where 'Cultured Meat may decrease the exposure of meat to bacteria, pathogens and diseases' (Pandurangan & Kim, 2015, p. 5392). As a delivery vehicle, Cultured Meat offers the advantage of, not just being less harmful, but potentially being the carrier of beneficial elements by 'substituting saturated fats with Omega 3' (Burningham, 2016; Hopkins & Dacey, 2008; Valeti, 2016). For milk, the problem of perishability where 'there are still viable bacteria after you pasteurise it and it goes bad... milk is known for going bad quickly' is solved by Muufri because:

Every molecule in this product is what we decided should be in there, in the exact amount that we decide should be in there, as it turns out we don't think that there's any room for bacteria in our products and that's a choice we can make, that's as it should be (Pandya, 2016).

The benefits of Synthetic Foods to animal welfare and habitat destruction mean that they are *better* for nature. The postulation on behalf of human health takes a different turn as The Movement say that their products can be scientifically manipulated, removing saturated fats and replacing them with Omega 3, to become *more-than-natural*. Not so much an improvement of unnatural but a domination of nature in a way that is said to promise better outcomes than can be produced by Animal Agriculture's unnatural practices. In any case, if the opposite of *icky* is *normal* and farming is icky, then Synthetic Foods must be normal and natural.

To overcome the ick factor means that The Movement will need to adhere actors to its Assemblage of relations in a process of translation. Frames are re-engineered that contain new conceptions of what nature now is. The young, smart and sexy actants and the celebrity investors associated with The Movement make it cool and inevitable. The simplified imagescapes and disciplined naming, normalises the practices for making Synthetic Foods. If Animal Agriculture is re-framed successfully as the residence of ickiness, then Cellular Agriculture might be accepted as its antithesis. The dialectic of 'icky' can only be natural or more-than-natural, even aspirational as redefined by The Movement in cultural terms.

5.2 Enacting Scale

The performativity of markets is a concept that is used here to explain how a materiality like Synthetic Foods can be arranged, so that a market appears inevitable. Callon (2007) quotes Deleuze and Guattari (1998) who use the word 'agencement' to describe these arrangements and there are examples of artefacts such as the financial equation named 'the Black and Scholes formula' which functions as a set of algorithms to shape investment, in other words 'the formula has become true, but it is preferable to say that the world it supposes has become actual' and the market is then said to have been made (Callon, 2007, p. 320). This is a similar sentiment to how Synthetic Foods is being enacted. Here are a series of presupposed *truths* from The Movement which discursively qualifies the market for Synthetic Foods as being a taken-for-granted notion, that is popular with investors on the production end of the commodity chain and is immanently arriving to an awaiting market on the consumption end, when the problem of scale is *inevitably* overcome.

5.2.1 Scaling Milk

To describe how the successful scaling of Synthetic Milk has been performed, it is necessary to track the evolution of the most important entity of Synthetic Milk, being Muufri, and the associated actors adhered to this organisation.

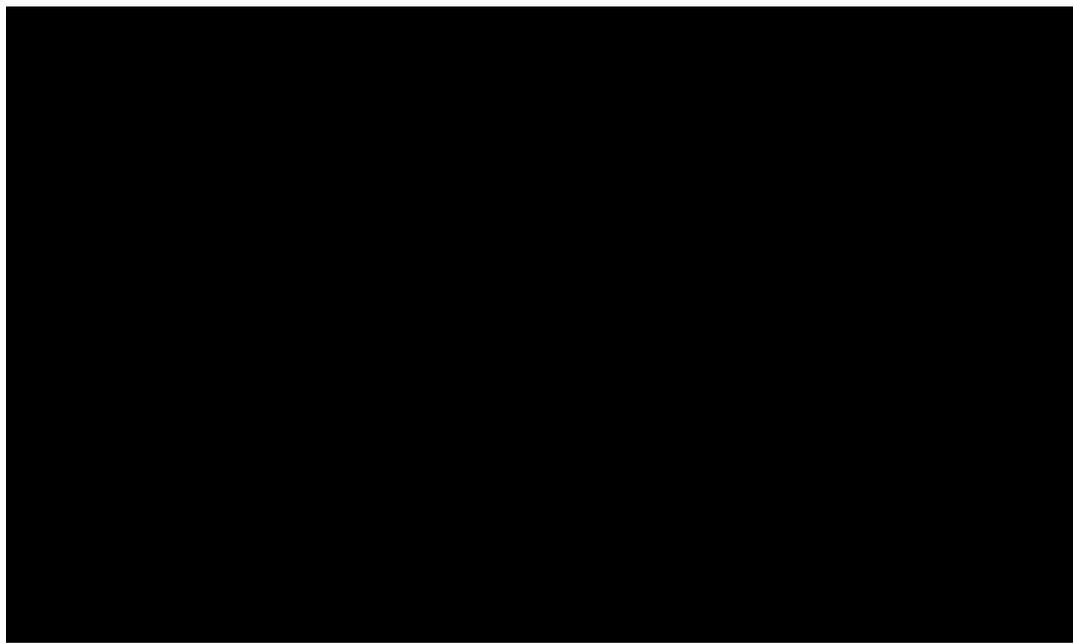


Figure 19. Mouat, M. (2016). [The First 3 Months of Muufri] (from New Harvest, 2016d). Adapted from http://www.new-harvest.org/perfect_day_foods

The first three months of Muufri, as summarised in Figure 19, is the beginning of a whirlwind adventure where a concept shared by three people is packaged in such a way as to attract funding for a proof of concept. This compact temporal frame is more than just a hasty agencement of an American and an Indian arranged by a Canadian and more than just funding and lab space. The valorisation of the idea of milk without cows by a Bioaccelerator and then subsequently, two internationally regarded newspapers means that Muufri has legitimacy. Milk without cows starts to become a *thing*, whether or not there is a site of exchange, exchange value or material packaging.

The second trimester of Muufri's commercial existence, summarised in Figure 20 on the next page, comes complete with the promissory narrative of inevitable commercial sustainability. The amount of \$2m USD supplied by the venture capital firm owned by Asia's richest man (Ka-Shing) gives the company a platform to expand. This smaller Assemblage within The Movement but which is networked into The Movement, now has a name, a logo and a handsome CEO as shown in Figure 21 on the following page.

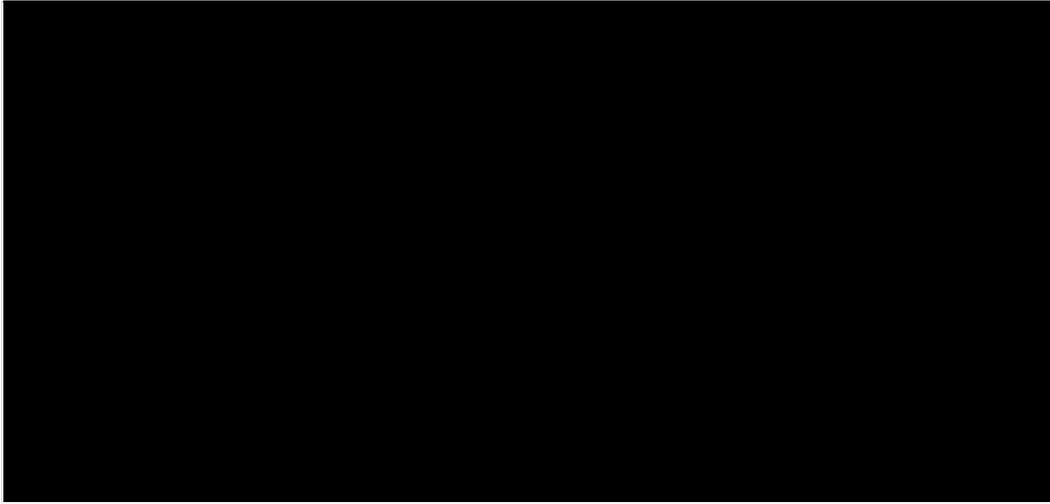


Figure 20. Mouat, M. (2016). [The Second 3 Months of Muufri] (from New Harvest, 2016d). (Adapted from http://www.new-harvest.org/perfect_day_foods)

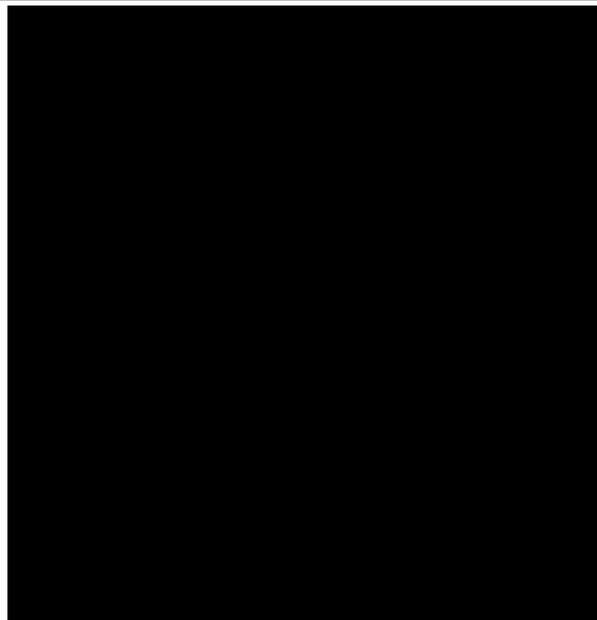


Figure 21. New Harvest. (2016d). [Muufri, complete with name, logo and handsome CEO]. Retrieved from http://www.new-harvest.org/perfect_day_foods

Muufri also has a Lab and a celebrity benefactor in the form of Li Ka-Shing, who is geographically located in Hong Kong. This geography is important as it potentially signals that Muufri may have a market in Asia for Milk Without Cows. Two of the products claims are that it can be made, without lactose which is advantageous to '90% of Asian consumers that are said to be lactose intolerant', and without bacteria, advantageous 'as much of the milk sold on Asian shelves is UHT due to lack of refrigeration' (Burke-Kennedy, 2015). What they don't now have is Datar who gifts her equity to

New Harvest to ‘keep the non-profit voice strong’ (New Harvest, 2016d). This action is arguably the single biggest exemplar of how non-economic values are crucial to the cultural way in which markets are shaped. These values often take precedence over what many would describe as an economically rational course of action, but they still have effects on how markets are assembled.

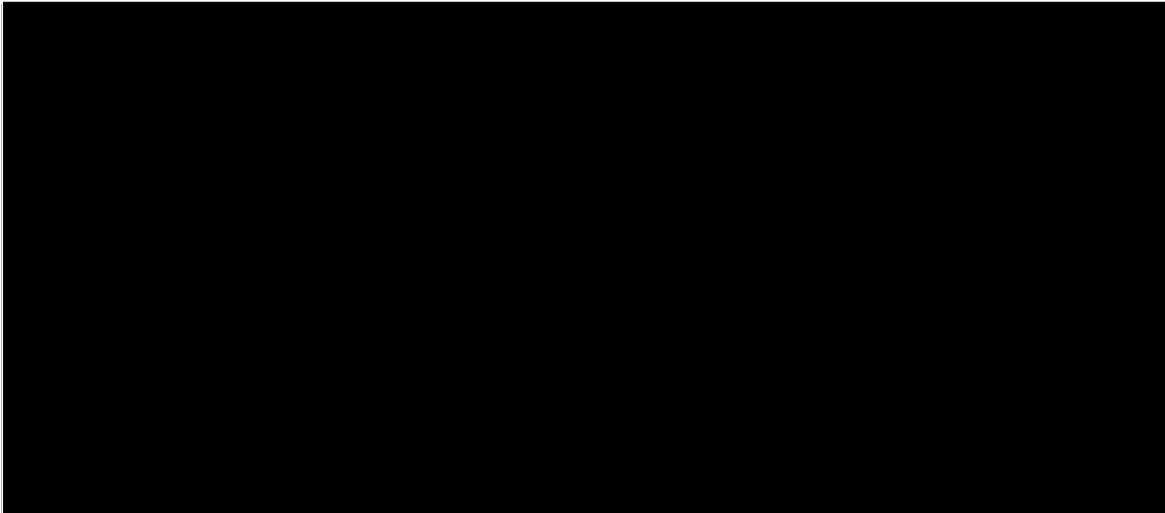


Figure 22. Mouat, M. (2016). [Perfect Day Foods aged 6 - 18 months] (from New Harvest, 2016d). Adapted from http://www.new-harvest.org/perfect_day_foods

The period after the initial six-month flurry, summarised in Figure 22, is notable for the self-imposed 2017 deadline. This deadline is an upgrade from the 2015 prediction that products would be available ‘as early as 2018’ (Pandya, 2015). Pandya subsequently states that ‘products’ will be ‘available in limited stores in the Bay area by 2017’ (Pandya, 2016). Other actors in The Movement have been conspicuous in avoiding predictions of when their products will be commercially available in stores. Synthetic Foods had been time agnostic in this way as there is never a timeline that their progress can be measured against, so they can proceed ad-infinitum without having failed to meet a target. That is until now, as it is argued here that the timeline imposed by Muufri is also a timeline imposed on the rest of The Movement because each actor is a subset of the other ‘like Chinese boxes’. These nested frames mean that ‘changes in the credibility of one frame have an effect on the credibility of the other’ (Buenza & Garud, 2007, pp. 31-32). Failure to meet the first publicly stated deadline from Perfect Day (as it will now be known, instead of Muufri for the rest of this thesis), might have an effect on the credibility of other Assemblages within The Movement.

Meeting the deadline is one variable for credibility, the other is the marginal cost per unit. In Pandya’s own words ‘if only twelve people can afford it then it’s unlikely to be able to solve

worldwide problems' (Pandya, Zilber, Delebecque, Lorestani, & Elizondo, 2016). So if Synthetic Milk retails at 5-10 times that of conventional milk, then the credibility of the product as something that might compete with conventional dairy, may be lost. However, even if the product were launched in the region of twice as expensive, then that would make it distinct enough for the consuming elite to afford it, especially in San Francisco where biotechnology innovation is arguably further along the socialisation continuum due to the agglomeration of biotech companies that make it their home. In this way, Perfect Day could 'appropriate quality' by pricing its products as more valuable and therefore more aspirational (Fairclough, 2001, p. 128). Olive oil colonised cooking oils in this manner where the 'habitus' of knowing consumers meant that they could differentiate their identity from the 'others', demonstrated by the quote 'we sauté our potatoes in olive oil, while *they* fry their chips in vegetable oil' (Paterson, 2006, pp.45-46). A successful launch in 2017, coupled with increasing demand could subsequently see Perfect Day become more affordable for the mass market, but a potential controversy is that the pricing remains accessible only to the elite.

The case of Synthetic Milk is a short vignette on how markets are performed and scalar progress is enacted. From conception in 2014, Perfect Day have garnered support from a wealthy benefactor to turbo boost the start-up. They have won business competitions and been valorised by sections of the business media which has accelerated their legitimacy as an entity that can produce Synthetic Milk. This story of progress is booked ended by a story of inevitability, where at the end of 2017, the first deadline for the entire Assemblage must have been met to maintain felicity. This deadline for a frame within a frame must be accompanied by what consumers would accept as a reasonable price for the performed progress to embed as actual progress, and this is assuming the 'ick factor' has been sufficiently overcome.

5.2.2 Scaling Meat

There are several ways in which Cultured Meat are performing progress in the quest to produce it more cost efficiently. Argued here is that the first move was to set a marker for costs of production and this was one of the purposes behind the *hamburger event* on TV (Cultured Beef, 2013). In a series of successive moves, subsequent to the marker of cost being established, scalar progress can then be re-measured and 're-qualified through negotiable scrutiny' as described in the discursive statements of the actors (Callon et al., 2003, pp. 60-64). These post event calculations of progress are then set against other *actual* products that have experienced rapid growth cycles, which normalises Cultured Meat by association and portrays a sense of inevitable becoming. After recalculating the progress, The Movement has been sure to mitigate against the possibility of

representing too much progress by detailing the complications of scaling the enabling technologies and affordability, after-all, if all the work has been done there is no more need to garner further economic support from potential benefactors. The enabling technologies, like battery technologies that enable the scaling and diffusion of electric cars, must be negotiated to successfully translate Cultured Meat into a market. These efficiencies are negotiated first in discourse, using loose and vague terminology so as not to create a deadline for availability, but all the while still framing Cultured Meats becoming as inevitable.

The argument that the TV hamburger event created a 'promotional public' (O'Riordan et al., 2016) is read another way here, in that it had the effect of establishing a cost marker, so that each subsequent discourse on cost efficiency can perform the work of scalar progression. The cost of the burger in August 2013 is said to have been \$330,000 USD (£250,000) 'which garnered considerable attention for its astronomical price' which was arguably the point of releasing the cost of the patty in the first place (Burningham, 2016). The important discursive work comes post-hamburger, where representations of decreasing costs, adds scalar progress to the Assemblage. Post along with Verstrate, co-founded a company called Mosa Meats and they make a statement published in *The Mirror* in March 2015, just 19 months post-hamburger, which is that the burger would now cost '\$11.36 per 142 gm patty or \$80 per Kg' (Solon, 2015). Later, in February 2016 the cost has seemingly stalled when Verstrate is quoted to say in *Newsweek* that 'the company can already make meat that costs \$27 to \$45 per pound', which happens to be \$59-\$99 per Kg, the midway point being \$80 per Kg (or \$11.36 for a hamburger patty), the same as quoted by Post nearly a year earlier (Burningham, 2016).

This can be interpreted in three ways. First that there has been no progress in cost efficiency for the 11 months from March 2015. Second, there have been no subsequent costing estimates produced. Third, the statement was produced to have a discursive impact that performs progress rather than to portray *actual* costs. In January 2016, the Cultured Meatball made by Valeti's Memphis Meats, cooked by a celebrity chef, tasted by a student and presented via You Tube broadcast, differed in four ways from the hamburger event. First, it was a meatball; hamburger had been done. Second, it was on *YouTube* not live TV; the TV event had been done. Third, it cost '\$40 per gm' or \$5,680 per Kg as opposed to \$80 per Kg represented by Post (Valeti, 2016). Last it 'tasted exactly the same as a normal meatball' (Memphis Meats, 2016b). The details as to why the meatball was much more expensive than the hamburger, might be because the taste is now *exactly* replicating beef whereas the hamburger was described as having only a 'familiar bite and mouthfeel' (O'Riordan et al., 2016,

p. 1). For the purposes of this argument what is most important is the discourse of dramatically tumbling costs in very short time frames to show scalar progress toward inevitability, rather than the differing numbers.

Datar (2016a) takes Valeti's calculation when she says that the important thing to note is that 'the costs of cellular production have declined from nearly \$300,000 to approximately \$18,000 per pound' (Datar, 2016a). In and of itself this dramatic economic efficiency is notable, however in the same way as greenhouse gases produced by Animal Agriculture are framed as being more than all types of transport combined, *comparisons* are what add the discursive weight to the argument and they also let the viewer co-create the meaning. For example, Bethencourt compares progress using a ubiquitous calculative comparison that is common when comparing the progress of innovations, Moore's Law, where 'every 18 months the cost of processing power [in computer chips] drops by half...we think biotechnology can go much further' (Niu, 2016). Valeti compares their progress with other medical technologies when he says that 'the cost to sequence a human genome has come down from \$3 million to \$3000 in 15 years' (Harris, 2016), as though first the Cultured Meat project is equally important and complicated as genome sequencing, and second, Cultured Meat has a comparable rate of scale which can be compared to a more familiar and therefore more normal breakthrough using biotechnology. The TV event set a marker, against which subsequent discourses of scalar progress can be compared without evidence and then aligned to other disruption scale technologies for affective impact that denotes inevitability.

One of the key enabling technologies that is represented as being a hurdle to overcome in scaling Cultured Meat is that of discovering a suitable *growth media*, or what feeds the growing cells nutrients so they can expand in the bioreactor. Currently this is done by using Foetal Bovine Serum (FBS hereafter) derived from unborn cows. Apart from the ethical considerations of invading the exact animals it is hoped that the technology will save, there is the additional problem of cost. FBS can cost as much as \$700 per litre, making 'a 25,000 Litre bioreactor which it is estimated would be needed for scaling production at comparable values as conventional meat' very expensive to fill with growth media (\$17.5M USD), although these costs are 'based on medical costs not food' (Post, Ellis, & Mozdziak, 2016). The solution is to find a Serum Free Medium which some suggest might be derived from 'adding plant and microbial material to basal media as supplementary sources of amino acids, peptides, vitamins and trace elements' (Mattick, Landis, Allenby, et al., 2015, p.11942). This media is estimated to need to cost 'no more than €1 per litre to bring the product within the range of conventional minced meat' (van der Weele & Tramper, 2014, p. 294). Perhaps sensing the

scale of overcoming the problem of scale, New Harvest 'are funding researchers to explore' this exact problem and the hope is for new gene manipulating technologies such as CRISPR/CAS9 (a new genome editing tool) to be used in speeding up the development (Dyen, 2016). The significance of needing to cut the cost of growth media by 99.8% is not to be underestimated. What is interesting is how little attention has been given to the gap between growth media costs now versus media costs in the future. One might speculate that this hurdle might work against the discursive *inevitability* of enacting scale, so it is at the same time marginalised in discourse, but all-the-while funded aggressively.

Cultured Meat handles the question of time to market, with a mixture of promissory narratives to denote inevitability and a lack of exact deadlines that 'denotes timelessness', unlike Synthetic Milk (Metcalf, 2013, p. 75). Mosa Meats says availability will be '2 to 3 years' (*The Economist*, 2016) or 'premium priced product in five years and five years after that...prices will be down to a level competitive to what we pay for beef now' (Burningham, 2016). Some actors avoid the temptation to name a deadline, even an inconsistent one, Kim saying instead that 'it's a question of funding not time' in a double movement that puts off a deadline and argues for pressure to be applied for reallocating Government funding of Agriculture in the United States (Holowack, 2016). Yet others re-appropriate the meaning of *time* to talk about the relative advantage that Cultured Meat is represented as having in terms of time taken to make a meat product, so Valeti compares growing times of '2-3 weeks for a fillet rather than the 6 months to a year for producing a cow' (Martin, 2016). The question of time to market is either avoided or reframed and so Cultured Meat development can proceed without deadline pressure but retain the appearance of inevitability.

For Cultured Meat, scale is represented as both happening at a rapid rate and requiring further support to disrupt conventional meat. The \$330,000 marker set by the hamburger event has enabled a discourse of progress to be performed post-hamburger. Mosa Meats and Memphis Meats have both exhibited their own style of demonstrating that their march down the cost curve is a breakthrough comparable to other disruptive technologies which are ontologically things that are said to exist, and culturally exist as things that are said to have altered cultural practices. The timeframe for impact is *soon* and no evidence is provided that can be used to disprove that assertion. Work is still to do and donations gratefully received, to overcome the problems of scaling the enabling technologies that will make the surrounding frame named Cultured Meat truly disruptive for Animal Agriculture. An independent white knight that helps to enact scale is therefore still relevant and that role is being performed by the frame called *New Harvest*.

5.2.3 Scaling New Harvest

Although The Movement is an Assemblage of interconnecting, temporarily stable relations, there is one entity that could be seen as an actor that approaches what Callon (1986, p.7) might call ‘the obligatory passage point’. New Harvest is an entity that is characterised by a number of loose, informal but highly influential associations among key actants, although it is Datar that is most visible since becoming CEO in 2013. New Harvest are a non-profit 501(c)(3) charity as defined by the IRS. This ontological reality concerning the organisations ‘non-profit’ status is often the first thing that actors representing this Assemblage publically assert in their opening remarks. At ‘Bitten 2016’ Datar mentions this in the second line of her presentation (Datar, 2016d), at the National Academy of Science she mentions it twice in the first thirty seconds (Datar, 2016e) and Kim mentions the ‘non-profit’ entity in an interview as being ‘the driving force accelerating breakthroughs’ and as ‘the reason why this industry is being advanced’ (Holowack, 2016).

Clearly the ‘non-profit’ voice holds important cultural capital to the actors that work or volunteer for the organisation. Datar embodies this by surrendering her start-up capital in Perfect Day to New Harvest as a donation which would allow New Harvest ‘to accelerate open source research should Perfect Day succeed’ (Datar, 2016b). This action signalled a change in strategy for the charity. Where once the strategy was to ‘build a field by creating start-ups’ the new direction was to begin funding research in order to create a base of knowledge available ‘in open access journals’ due to start-ups being ‘inherently unstable’ (Datar, 2016b). After this strategy change which could equally be seen as a change that pins future economic success to current cultural transformation, New Harvest became an organisation that ‘funds the gap between food science and medical science’ (Datar, 2016e).

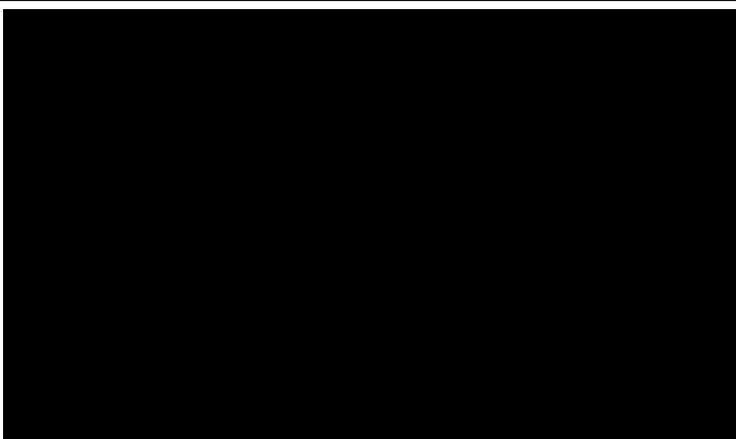


Figure 23. Mouat, M. (2016). [Contributions to New Harvest from 2015 IRS 990]. Received and adapted from Personal Communication, November 18, 2016.

With this change in strategy came a change in support. Previous to 2016, the profile of donators were ‘people who are future consumers...a distributed network’ (Datar, 2016e) and the charity was beginning to get a significant amount of momentum from this contributory assemblage as shown in Figure 23 , where the

donations rose by 18X from 2013-2015 according to the IRS 990 form provided by Datar (Personal Communication, November 18, 2016). The bigger change came when The Shuttleworth Foundation, an 'open knowledge society' fund headed by the aforementioned celebrity investor and space tourist Mark Shuttleworth (The Shuttleworth Foundation, 2016), accepted New Harvest's application for funding. This was in 2016 so will not show up on the 2015 IRS 990 form. The funding was structured in four ways. First, they would fund Datar's salary for a year, a meagre \$45,000 in 2015, which says even more about the non-economic drive behind surrendering her equity in Perfect Day. Second, they would multiply by 10X, anything that she donated back from her salary. Third, they would fund the creation of a line of starter cultures for beef, pork, and chicken that were 'freely accessible' to any researchers wanting to begin research into Cultured Meat, overcoming the need to obtain samples from friendly abattoirs or expensive suppliers. Fourth, they would fund a 'wet lab in Leiden, The Netherlands' dedicated to open source, IP free research. This lab provides not only research facilities but 'provides a base to access European grants and philanthropy' (Datar, 2016f). Research into Synthetic Foods now has a home nestled among a distributed network of research that now houses recently adhered actors such as Luining at the Leiden Lab, Glencross at Kings College London and Rubio at Tufts University Boston.

The concept of 'disruptive innovation' is a business term widely attributed to Clay Christensen who studied the hard disk drive industry. The resulting book *The Innovators Dilemma* described a number of scenario's as to why well-funded incumbent firms were overcome by new entrants with new technologies and/or business models (Christensen, 2011). Since then 'disruption' has been a business buzz word used to explain everything from the becoming of electric vehicles and solar energy in the face of competing interests from transnational corporations (Seba, 2014), to the disruptive business models performed by *Uber* and *Pandora* (Anthony, 2016). In social science, similar sentiments to disruptive innovation can be found in the notion of 'counterperformativity', a condition where 'an assemblage performs an adaptation' in instances where stability fails or the conditions of domesticated felicity are not met (Callon, 2007, p. 323). For the Synthetic Foods movement, disruption is the major goal in making animal products without animals and it forms part of The Movement's constructed identity, as cool, young activists using science and capitalism to rescue us from the evil status quo. Valeti uses a well-worn disruption metaphor by saying 'we plan to do to Animal Agriculture what the car did to the horse and buggy, Cultured Meat will completely replace the status quo and make raising animals to eat them simply unthinkable' (Sagan, 2016). New Harvest outwardly occupies the middle ground between the hard line activism that would have Animal Agriculture end tomorrow in what Foucault described as 'the destruction of what we are and

the creation of something completely other, a total innovation' (Han, 2002, p. 163), and just an end to 'Factory Farming'.

Perhaps as a way to avoid evoking fear in consumers of having to rapidly renounce their self-identity as meat eaters, which we have discussed leads to a feeling of 'ick', New Harvest prefers to describe



this process as 'evolution' rather than 'revolution'. In Figure 24 we see that the natural course of things, resembling the 'evolution of man' image from Ape to Bowler Hat wearing Accountant, has been for hunting to give way to domestication that gives way to industrialisation. This has been the historical genealogy of moments. What is also represented as an ontological certainty, is that the thousands of chickens being conveyed through an industrial relic of the 20th century (3rd image from the left, already 16 years past) will give way to Cell Cultivation in the modern era, where foods are now made in copper artisanal bioreactors (image at far right) (Datar, 2016d). Datar (2016a) is said to quote Buckminster Fuller who says that 'the best way to predict the future is to create it'. New Harvest performs the discursive work for making cell cultivation a disruptive certainty but without being frighteningly confronting.

New Harvest represents itself as an actor that speaks on behalf of, and advocates for the entire Assemblage which pre-supposes a market. Synthetic Milk and Meat perform their own versions of progress with the major difference being that Synthetic Milk is encumbered, or perhaps motivated, by their self-induced ticking clock. The performativity of scale by actors of The Movement has the potential to become a series of disruptive technologies, in a market that is socially accepting of disruption, because of the number of disruptive technologies that have already successfully scaled

up in recent years such as smart phones, digital cameras and Uber. The representation of scale as being an ontological certainty gives rise to the expectation of inevitability and these expectations themselves become performative. The 'sociology of expectations' provides impetus for mobilising political and economic resources towards this promised future (Chiles, 2013).

Perfect Day performs Synthetic Milk's scale through storytelling narratives outlining rapid accumulations of financial support. *Mosa Meats* and *Memphis Meats* tell stories of their rapid march down the cost curve. Of late, *New Harvest* have performed scale by changing strategy that has led to increased donations and ultimately a single large benefactor for scaling the base of science in Cellular Agriculture research via *The Shuttleworth Foundation*. The multitude of actors that add scalar ability to the entire Assemblage is distinctive of an ant like 'swarm intelligence' where a distributed network of actors attacks the previously stable edifice of Animal Agriculture from all sides, to vanquish what was there before and appropriate their ground (Hardt & Negri, 2004, p. 91). The Movement led by *New Harvest* could be seen as 'working for life' in a cultural war of differing ethical values (Heelas, 2002, p. 93). The Movement is enacting scale so as to create a prophecy of foods future that becomes self-fulfilling. The more actants that bind to The Movement's side of the Assemblage based on cultural values, the more Factory Farming occupies an imagined future where it is thought of as an unthinkable relic of industrialisation when compared to the promise of Synthetic Foods and the market it pre-supposes.

5.3 Assembling Non-Humans

Ode to William H. Channing

*The horseman serves the horse,
The neat-herd serves the neat,
The merchant serves the purse,
The eater serves his meat;
'Tis the day of the chattel,
Web to weave, and corn to grind,
Things are in the saddle,
And ride mankind [emphasis added].* - (Emerson, 1867)

If this Assemblage is bringing nature and culture together in a new fashion, then we have only told its story in terms of human agency, therefore from a merely social perspective. The role of this section is to show that there are non-human actors with agency, which are part of this Assemblage too. The story of nature must be told to balance out and bring together the argument that nature

and culture are being recombined through a new inscription of food. ‘Human societies are never wholly human, any more than they are wholly adult, wholly male or wholly rational’ (Murdoch, 1997, p. 732). Throughout the empirical chapters there have been many examples where it has been shown that the non-human has been represented as auto-enrolled, black-boxed and therefore stably translated into the Assemblage. Such may not be the case. First we will take another two examples of simplification suggested by The Movement, including one that really does use a ‘black box’ as the metaphor, to show how non-humans are represented as already stabilised. Then we will problematise this stabilising of non-human actors and see how they might affect agency in unexpected ways.



Here in Figure 25 we see meat represented as a simplified agglomeration of cells all bound together into muscle fibres, which are bound together in a larger assemblage that we call meat. ‘As you can see, Cultured Meat is the same as meat from an animal’ (Datar, 2016d). This is a simplification of what meat is and how its components behave. The black box metaphor is either intentionally or

accidentally appropriated to mean something else in Pandya (2016), where he describes the familiar figure (Figure 7 from Chapter 4) of the blue cow, above an actual picture of a black box in Figure 26 located on the next page. He explains that the metabolic process which occurs inside a cow to produce milk is mysterious in that ‘we don’t really understand what that creature is doing... it’s just a black box because we don’t really know what’s going on, so why don’t we look at it like a black box’. Here, an actor from Microbiology borrows from Social Science to explain what all the non-human microbes are doing inside the non-human cow. But as Pandya (2016) admits ‘we don’t really know what’s going on’, so if nobody knows what’s going on, how can it be replicated so exactly? How can

human actors reliably speak on behalf of the non-human? Here are some problems with the logic of simplification and by extension the process for translating non-humans into a network.

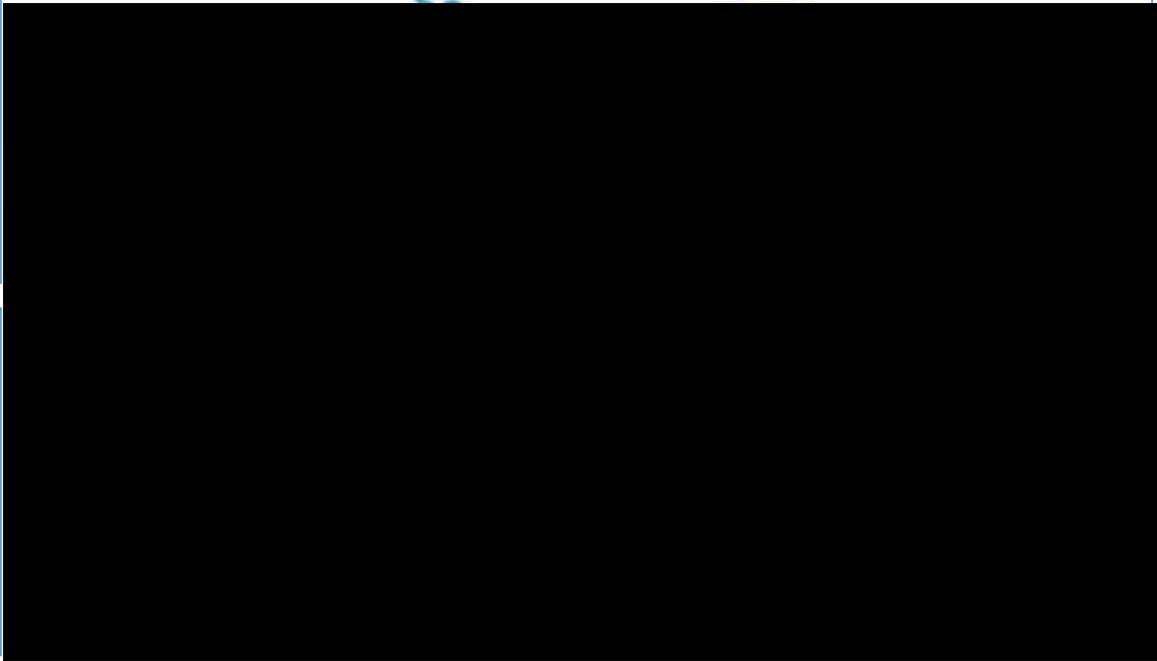


Figure 26. Pandya, R. (2016, March 16). *Developing the Animal-Free Future of Dairy* [Video File]. Retrieved from <https://www.youtube.com/watch?v=ww7gjWg5wTY>

Speaking on behalf of non-humans is problematic because, as Pandya (2016) suggests, they are complicated machines that are hard to fully understand and in some cases microscopically small. This is not to say that the non-human cannot be translated, Pasteur translated *Bacillus Anthracis* to create a vaccine against Anthrax (Latour, 1983). However, non-humans are not always so reliable, Callon (1986, p.211) describes how non-human Scallops refuse to bind to their collectors in a way that destabilises the network created by three scientists that seek to repopulate them in the St. Brieuc Bay and thus 'translation becomes treason'. 'We humans differ from non-humans precisely in that our actions have intentions behind them whereas the performance [behaviours] of quarks, microbes, and machine tools do not' (Pickering, 1993 as cited in Murdoch, 1997, p. 746). So yeast cells, cow DNA, myocyte meat cells and stem cells are all microbial non-human elements that are said to have been already translated or are inevitably going to have been translated into a network for creating various Synthetic Foods.

It is argued here that this translation cannot be known but like Pasteur's *Bacillus* it can be represented as being known, although translation can equally be destabilised through the treasonous agency of non-human actors, like Scallops. Even if a synthetic product can be produced,

scaled up and sold to willing consumers 'nature acting back on itself in a boomerang effect is always a possibility as exemplified by previously stable prion proteins suddenly giving rise to BSE (Mad Cow Disease)' (Murdoch et al., 2000, p. 110). The first instance of a person getting sick from a Synthetic Foods product or of a process becoming contaminated, could have a destabilising effect on the entire Assemblage as they are all interrelated to one degree or another in nested frames. The status quo of Animal Agriculture has suffered similar setbacks, just taking the example of Fonterra in the last few years we have seen the Chinese infant formula Melamine scandal and the Botulism scare, but these networks have shown remarkable resilience due to the length and strength of their relations. The question of whether The Movement could be as resilient in the face of such scandal that erupts from non-humans exercising agency and revoking their membership of the Assemblage is an open one, but one that must be allowed for in order to balance the discursive representations of non-human elements being simplified into black boxes.

Other non-human artefacts such as bioreactors, growth media and scaffolding all have agency that can be exercised to change outcomes. Research illustrates how non-human agency can shape social groups, such as AOD (Alcohol and Other Drugs) use in Melbourne and Vancouver, which is described as 'a network outcome where objects like mobile phones, clothing and music can either enable or constrain participants of the network' (Duff, 2012, p. 154). The cost of growth media and the search for an as yet unknown replacement for Foetal Bovine Serum in Cultured Meat production, is an example of a non-human element that is defined as having been translated, but not on terms suitable enough for it to be incorporated into the Assemblage as human actors might envision.

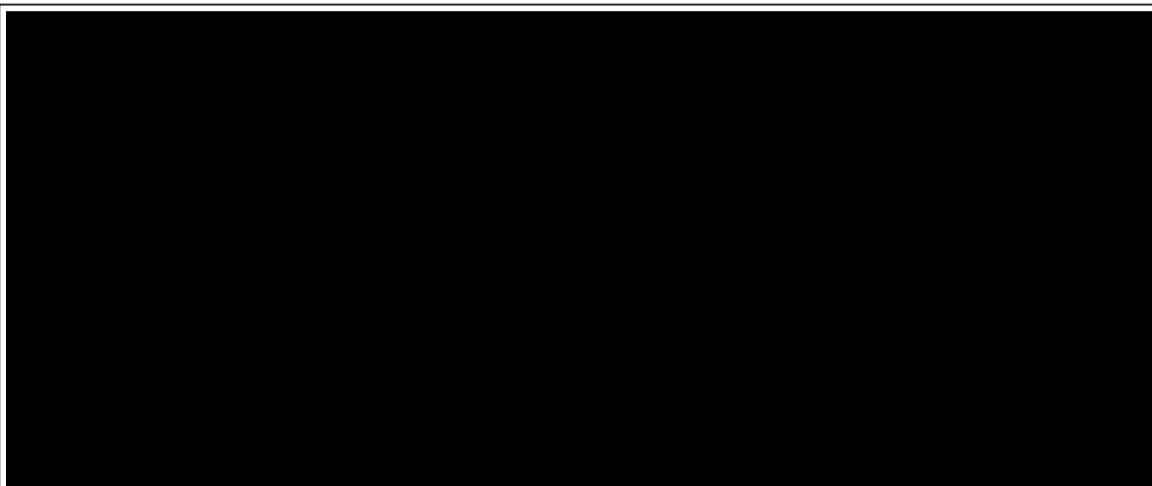


Figure 27. Datar, I., & Betti, M. (2010). Possibilities for an in vitro meat production system [Fig. 2, p. 20]. *Innovative Food Science & Emerging Technologies*, 11(1), 13-22. doi: 10.1016/j.ifset.2009.10.007

Similarly, bioreactors are simplified apparatuses as represented on the prior page in Figure 27. but what must also be negotiated is the materials they should be made of, what they cost to manufacture, what to fill them with, how to power them, how to deal with the waste produced and so on because 'each actor is always a network' whether human or non-human (Law, 1992 as cited in Murdoch, 1997, p. 748). If actors are also networks there could be elements of those networks that disrupt the Assemblage, so if the wrong material is chosen to construct bioreactors then the entire Assemblage might become vulnerable to the agency of this non-human material.

Microbial non-human actors like cells are themselves assemblages of proteins and quarks that may not be stabilised in a way that human actors hope and if they do, they may only be translated temporarily, only to disrupt the network when they boomerang back in violence. The Synthetic Foods Assemblage consists of actants described as architectural enablers or constrainers such as growth media and bioreactors, which also consist of complicated assemblages nested within their frames. To speak on behalf of non-humans, that have no known intentionality is precarious although not without precedent. Animal Agriculture constantly has to negotiate and renegotiate with non-humans and can recover even when translation becomes treason. Taking Emerson's (1867) conception of the non-human in his poem at the top of this section, sometimes the 'things in the saddle, that ride mankind' are enrolled into an assemblage and told in which direction to ride.

5.4 Conclusion

The Movement is an Assemblage of actors creating a ruckus. The donnybrook of discursive framing is rallying against the practices that have torn economy from culture and culture from nature. The Movement is argued here as making a market for Synthetic Foods that brings nature and culture back together in a new way and in a contemporary assemblage held together by the 'phenomenon of perception' (Deleuze and Parnet, 1989 as cited in Tampio, 2009, p. 392). Animal Agriculture is framed as starting from their own interests and then extending out, whereas The Movement offers to invert this by starting with planet level problems and providing a partial solution in the form of more natural food that originates from within science. Having the actors speak on behalf of the Assemblage, of which it is hoped cultures humans and natures non-humans will adhere, requires the negotiation of relations through a process of translation. In translation we can locate the discursive work of The Movement as it assembles and performs the market for Synthetic Foods.

Translation requires a pre-emptive strike against the 'ick factor'. On one front, The Movement deploys their young, smart and sexy actors to more-than-normalise the Synthetic Foods Assemblage.

On another, celebrity investors and the immaterial associations that are imagined when they are seen to be promoting Synthetic Foods as an innovative technology, makes the Assemblage's development seem inevitable because the presumption is that these investors don't make bad business decisions and consumers might imagine themselves as being kindred spirits of the innovation generation. On a third, normalising Synthetic Foods by associating the production process with the socially acceptable production process of using biotechnology to create beer is the job of the brewery narrative. Fourth, normalising Synthetic Foods by combining socially acceptable signifiers such as 'cellular' and 'agriculture' to create a new name in the form of signs such as 'Cellular Agriculture' or 'Cultured Meat' is a way of prefabricating walls that frame what The Movement's practices are and governing the manner in which they should be communicated. Next was shown that the scientific practices of The Movement are the antithesis to the unnatural practices of creating food from animals, although the resulting products are defined as being the same. The practices of Animal Agriculture are undermined and overflowed, their frames are shown to house the visceral embodiment of 'ickiness'. The antidote to 'icky' Animal Agriculture products is its binary other, the more natural or even more-than-natural products of clean animal foods from Cellular Agriculture.

The evidence provided by actors of The Movement for the uncommonly speedy rate at which their technology is being scaled up, enacts a market for Synthetic Foods that is arriving *inevitably soon*. For *Milk Without Cows*, *Perfect Day* promises that proof of an ontological market will be here by the end of 2017, a timeline that is important to *Perfect Day* and its investors but also important for the entire Assemblage that consists of multifarious frames that are nested within. Perhaps *Perfect Day* were spurred on by the retelling of how successfully they attracted funding; in contrast Cultured Meat deals with their timeline to market very differently. Cultured Meat is characterised by a beggars' muddle of predictive indications that denote progress but is free to operate in a temporal no man's land due to the lack of a self-stated deadline. The \$330,000 marker created by the hamburger event means that, real or imagined claims of rapid improvements in costs of production can be made, while at the same time making it clear that there is much more work to do in order to be competitive with conventional meat, so please keep the funding coming. Funding is what *New Harvest* does, or more precisely it is an entity that calculates the length of relations within the Assemblage in terms of money. If money equals the length of relations then *New Harvest* can be said to have exponentially extended their network of heterogeneous associations since 2013 and by extension, so too has The Movement's concept of the Assemblage which is arranged across a myriad of topological sites. The Movement are about communication just as much as they are about

science, maybe more so. The sometimes disciplined messages from The Movement convey an invitation for all to join and once enrolled in the Assemblage, together it can swarm Animal Agriculture which is now no longer required or desired.

All the outwardly communicated productions of The Movement are designed to interest humans. When actors of The Movement focus inward, they must negotiate with non-humans. Much of the outgoing communications portray the non-human as already enrolled into the network but black boxes may never be fully closed, their lids may be ajar. The non-human has agency and just by calling them enrolled, doesn't necessarily make it so, or if it is so, then it may be only temporarily so. There are numerous examples of nature boomeranging back in unexpected ways and although this possibility is not part of the discursive framework communicated by The Movement, it must be allowed for in a discussion that has non-humans as actors in a productive assemblage.

What is striking about the methods to assemble Synthetic Foods as being the natural space for food, is the discursive weight of immaterial performances. While a material production such as cooking Cultured Meat on live TV can be produced just once, it can be immaterially reproduced ad-infinitum. Ideas, knowledges and languages are difficult to claim as private property which gives them the ability to proliferate in a world where communication technologies abound, but their meaning can also be creatively co-constructed or changed. The argument that Synthetic Foods is an edifice that brings nature and culture back together anew, is situated and contingent on many variables, both human and non-human, so a prediction of which truth will ultimately make a market, is problematic. All that can be said is that this is what one reading of what has happened so far, might be.

Chapter 6 – Discussion

This chapter offers a discussion on a few points highlighted in this reading of how a market for Synthetic Foods is being assembled. But what must be done first is to summarise the empirical work, where The Movement uses discourse to attempt to disassemble Animal Agriculture as the provider of natural foods and then assembles a market for Synthetic Foods as the natural alternative. The opportunity is then taken to explain what meaning can be drawn from this work and what potential futures might appear. The natural evolution of such speculation is to recommend what future paths of study might be undertaken so that these speculations might be supported or otherwise, in the light of readings from another perspective. At last we will arrive at what this thesis offers to thinking about Economic Geography, Markets and relational spaces.

6.1 Summary of Disassembling and Assembling Discourses

Western culture has decoupled nature from culture in successive moments that has created a binary. Different modes of governmentality have mobilised this discourse, ranging from godly warrant to legislated town planning. In the industrial age, society has been purified by banishing nature to the periphery, outside the citadels of human achievement. Upon returning to the cities, nature in the form of food products could be enjoyed by consumers, cleansed from the association of its lowly origins as enabled through the spatial separation between slaughterhouse and supermarket. The Movement is an assemblage that problematises this binary and reframes Animal Agriculture as unnatural by highlighting its overflows. These overflows are critically represented as being a threat to the continued survivability of nature, in which society is a part of, rather than apart from. The Movement itself can be seen as an unintended overflow of conventional Animal Agriculture, but the cultural practices of producing Synthetic Foods are offered as being better for and closer to nature, therefore the dualist hierarchy of culture dominating nature is destabilised.

Re-represented in this thesis are three discursive arguments from The Movement that decouple Animal Agriculture from being natural. The first and some say the most important target that works to bind many of The Movement's actors together is a shared concern for Animal Welfare. Non-human animals are black boxed into a network that feeds Humanity via the convenience of a supermarket and the network of practices within Animal Agriculture becomes simplified. The Movement's actors share a disciplined language by naming the outcome of this process 'slaughter', they tell stories about the unnatural cruelty of this slaughtering and produce their own simplifications in the form of photographs which are said to represent the inhuman reality of 'Factory Farming' for non-human animals.

Next has been shown the ways in which The Movement co-opts discourses produced in other media such as film and combines these with officiously qualified statistics that problematises Animal Agriculture's impact on nature's water, forests and climate. These devices for governing thought can produce a 'promotional public' which adheres itself to the Assemblage on The Movement's terms and proliferates the discourses that problematise the farming of animals for food. The third discourse to disassemble Animal Agriculture's claim to naturalness is that of impacts to human health. Images and statistics combine again to command a rethink of what Factory Farming really is when The Movement explains the links between zoonotic disease spread, antibiotic resistance, heart health and faecal contamination of animal derived food. The coordinated, disciplined and shared weaponry of The Movement, attacks the ways in which Animal Agriculture can be thought about. The way in which the cultural production of Animal Agriculture has provided it an identity as the simplified deliverer of natural products and therefore natural in itself, is disrupted by The Movement's problematising discourses which highlight its unnatural practices and anti-nature outcomes.

Among the crumbling ramparts of Animal Agriculture, The Movement seeks then to construct a new edifice, to assemble new frames that contain new practices of producing natural animal foods and this then is making a market for Synthetic Foods. The Assemblage translates and adheres actants to it, which sees this new Leviathan grow and be seen to grow in a way suitable to The Movement. Synthetic Foods are normalised through the display of relations among its sexy, young, smart and cool actors, celebrity investors, names that normalise and imaginings of how 'Cellular Agriculture' can be the antidote for the evils begat by Animal Agriculture. The market for Synthetic Foods is performed in part through productively enacting scale and the progress embodied by the stories of *Perfect Day's* growth, *Cultured Meat's* efficiency increases and *New Harvest's* ballooning support. This assemblage portrays a swarm like becoming of Synthetic Foods that foreshadows an offer for an *inevitably* disruptive technology. This black boxing of foods future, auto-enrols the non-human, as an actor that is stably translated for working on behalf of the Assemblage. However, the non-human has agency, nature can boomerang back and therefore the black boxes that are said to contain compliant non-humans are always precarious. Perhaps even a provisionally stable Assemblage may be enough to make a market for Synthetic Foods, a new frame created from the overflows of Animal Agriculture like a Phoenix that burns down its enemy's house and triumphantly arises from the ashes.

The Movement is a social and cultural construct as demonstrated by the cooperative nature of actors' relations in solving the problem of 'Factory Farming'. Traditional economics may explain the becoming of this market differently through various theories on innovation, but to limit the analysis to economic drivers misses the bulk of the explanatory work. The Movement makes a spectacle of their own cultural drivers such as animal welfare, improving the natural environment and human health at the same time as exposing how unnatural cultural practices, are always and have always been, integral to the economic performance of Animal Agriculture. In a market such as this, when culture shifts, economies must come along too as they are imbricated and associated heterogeneously.

6.2 Cultural Economy: Speculations and Futures

In this chapter, the opportunity is taken to make a number of speculations regarding the future impacts of the market for Synthetic Foods. First to be considered is a comparison between what spatialities might mean for places where a market for Synthetic Foods might take hold. Then, there is a view offered about what characteristics of The Movement might bring about the hastening of Animal Agriculture's disassembling followed by what characteristics might hasten the assembling of the Synthetic Foods market. Then follows conjectures relating to potential controversies within The Movement which might have a destabilising effect. Lastly opined will be to surmise about the lack of visible counterargument from Animal Agriculture.

The spatial differences of place are variable factors that might either hinder or promote the diffusion of Synthetic Foods. Farming is an important part of New Zealand's history and forms much of its citizenry's national identity. Implied is the associational ability to overcome barriers through toughness and innovative problem solving as embodied in the metaphor of No.8 wire. When advertising a hardy new Ute, the voiceover must be that of a gruff husky voice synonymous with a man of the land. In recreation, Kiwis can still exercise domination over nature by hunting or fishing. When not wrestling livestock, we can wrestle each other on the rugby field that frames our national sport and which really is referred to as a paddock. Much of our national identity and practices allow us 'to relive the fantasy of the pioneering life' (Phillips, 1996 cited in Mansvelt, 2005, p. 72).

The 'ick factor' of Synthetic Foods may well be amplified in this setting and therefore struggle to take hold, especially if it is seen as not just a threat to national identity but a threat to what is widely believed to be the most productive part of NZ's economy, even if an accurate allowance for externalised costs could be made. In geographies without this identity however the 'ick factor' may

be much less of a barrier. One might speculate that very few of the 22 million or so inhabitants of Beijing, care much about their imagined affinity to the land. In any case, the market for Synthetic Foods is unlikely to target NZ as a must win battleground, therefore the findings from qualitative research suggesting that western consumers may not be welcoming of Synthetic Foods is potentially irrelevant when trying to decipher the likelihood of a market forming, other than to provide the local Agrifood Assemblages a precarious peace of mind. The markets which are most important are those in the 'new burgeoning middle classes of India, China and Brazil, where middle class youth brought up in post 1980's abundance are interested in consuming and a wealthy elite are opening up the high end costly market', as Li-Ka Shing no doubt has envisaged when he funded many Synthetic Foods start-ups (Birkner, 2014, pp. 27-31).

To return to what on first appearances seems like a more economic speculation about Synthetic Foods future, here we discuss the potential effect of Synthetic Foods proliferation, on Animal Agriculture's economies of scale. For instance, the cost of producing a unit of cattle meat is reduced by being able to sell some of the rest of the carcass as a by-product, such as the skin for leather. The threat to conventional meat is consequently exacerbated by other biofabricating companies of The Movement such as *Modern Meadow* who are seeking to lab grow and or 3D print leather for the \$90 billion per year fashion industry (Kolodny, 2016). If successful at disrupting this market, the cost per unit of cattle meat must rise to keep the same margins, therefore the retail price moves closer to the potential sale price of Cultured Meat. Add to this the reduction of retired female and surviving male dairy cattle that are used for meat production, if *Perfect Day* are successful in disrupting the dairy products market and with it the population of dairy cattle decreases, then price parity between Synthetic and Conventional Meat moves closer still and this is to say nothing of what would happen if global Governments, especially in the United States, decide to remove their subsidy support for agricultural meat production. In meat production, the economies of scale enjoyed by Animal Agriculture might be denuded by the actions of actors in The Movement that are not necessarily in direct competition for supplying meat, but are similarly mobilised by the common drive to make Factory Farming obsolete. Again, this would show how the cultural and the economic are inextricably linked.

These linkages of culture and economy mirror linkages that are crucial to explaining The Movement. There is an interconnectedness of actors that work together in a coordinated effort to promote the Assemblage as a whole. This collaboration may creatively perform a market more hastily than in a traditional market where competition between actors is a main driver of innovation. The

competitive energy of The Movement is focussed towards the destruction of Factory Farming and by extension Animal Agriculture. Post, when asked about the perceived threat to Cultured Meat from a new generation of plant based meat alternatives said that ‘we strive to reach the same goals, to feed people without the negative consequences on the environment, food security and animal suffering. I’m doing this because people love meat but if they [plant based alternatives] win then I would be very happy’ (Post et al., 2016). Valeti is quoted as saying ‘we need to have about a thousand Cultured Meat companies in the world, our competition is the existing meat industry’ (Burningham, 2016). Apart from the IP free research funded through *New Harvest* and *The Shuttleworth Foundation*, these examples of actual corporate actors indicating a willingness to collaborate in their quest to vanquish a common enemy in Animal Agriculture, is evidence of a developing Assemblage with entrenched cultural values.

But cultural links, like all attachments, are not always uniform, not always united, they are relational associations which are contingent and impermanent. Some indications from some actors may signal actual current and potential future controversies within The Movement that might destabilise their translation of the Assemblage. For example, when explaining why Synthetic Milk is a more exciting prospect than Cultured Meat, Pandya (2016) says that ‘it’s [Cultured Meat] not going to be in your home within ten years’ and that of the process he rephrases the preferred discourse of inevitability, by stating ‘we’re [he acts as a Cultured Meat producer] pretty sure they won’t die [meat cells] if we feed them this \$600 a gram mixture’. Brown, CEO of Gates backed *Beyond Meat*, makes new generation vegeburgers which he prefers as a conventional meat alternative, rather than the prospect of Cultured Meat because ‘I don’t want an endless science project’ and in the same media segment Post rebuts, ‘I haven’t found a vegeburger that can fool me yet’ in support of Cultured Meat (*The Economist*, 2016). There are some inconsistencies and tensions between how actors from Cultured Meat, Milk Without Cows and plant based meats choose to portray each other’s technologies, which might undermine The Movement’s rendering of the Assemblage.

Another potential source of conflict is the tensions between cultural and financial reward. Where Datar is clearly passionate about promulgating knowledge in an open access arena that furthers the scientific base of research as demonstrated by her surrender of *Perfect Day* equity so as to keep the non-profit voice strong, Pandya has a different view when it comes to *Perfect Day*’s contribution. He states a preference for ‘licencing’ as a business model and defends the necessity for protecting their Intellectual Property (IP) in a contrasting view to, using his example, Tesla’s open sharing of electric vehicle battery IP. He does offer the caveat that the ‘ultimate goal is to share it with everyone

because it doesn't work [I assume he means ending Factory Farming] if we're the only one's doing it' (Pandya et al., 2016). The most likely reason to protect IP and licence it is to maximise the return on investment and this is an economic factor which must be necessarily balanced against cultural drivers, as it should be in a discussion using a Cultural Economy approach.

One might speculate that if *Perfect Day* was only interested in making Factory Farming obsolete, they could release their IP into an open source arena so anyone could attempt to ferment their own milk in the same way as people home brew beer. Clearly this would diffuse the technology wider and faster than licencing and hasten the demise of dairy farming, but the economic interests of both celebrity investors and the innovative scientists are not without relevance, *because* they are cultural productions. These controversies reinforce the point that Cultural Economy inexorably links culture and economy so that one may not be considered without the other. Cultural motives alone might fail to find sufficient start-up capital without economic motives and economic motives alone might fail to gain the ground swell of societal support that would catapult a technology through the adoption curve. The Movement is not without internal controversies or competition and not devoid of maximising economic profitability even if it delays the cultural change that it portrays as being so deeply sought. Once again culture drives economic processes and the different ways in which economic rewards are sought are themselves culturally mediated by actors. Just because members of The Movement adhere to the Assemblage doesn't mean they necessarily cohere in a uniform manner.

An overwhelming impression that can be gleaned from collecting views on Synthetic Foods is that there is a deafening silence of counter-argument from Animal Agriculture stakeholders. Taking just the case of Synthetic Milk, one would imagine that NZ's largest company *Fonterra* is well briefed on the subject and such may be the case, yet publically Jeremy Hill the R&D Director for *Fonterra* states that 'replicating cow's milk on a large scale is too complex' and that '*Fonterra* does not see this as a serious threat'. In the same article Minister for Primary Industries, Nathan Guy, dismisses Milk Without Cows stating that he 'prefers our *natural* milk [Emphasis added], produced from fantastic NZ pastures...I won't be rushing out to purchase a carton' (Wannan, 2014).

Pandya (2015) represents that 'we're already talking to six multinational food companies that are eager to get involved' and one might imagine that one of these is dairy giant *Nestlé*, considering Ann Veneman of the *Nestlé* Board is pictured on the *Perfect Day* 'team of advisors' slide, complete with *Nestlé* logo. So *Nestlé's* response might be to work in the forefront of a potential nascent technology

whereas rival *Fonterra* seems content to dismiss the possibility, with help from politicians. This is one interpretation. Another might be that *Fonterra* is actually one of the six multinationals talking to *Perfect Day* but are withholding that information from shareholder suppliers in order to retain supply until it can be replaced reliably by Synthetic Milk. The economic impact of dairy farms becoming unproductive assets may well be crippling for farmers and the larger economy, or alternatively, may be an economic boon. Let's take an example of a notional *Fonterra* shareholder supplier that holds 500,000 'wet' shares that are a requirement in order to be a fully paid up supplier for 500,000 kg of milk solids. If those shares which hypothetically trade for around \$6 then become worth \$60, because the vast majority of costs of goods sold for producing milk products is now replaced by a much lower cost method of producing milk, then the \$3m value of the shares then becomes \$30m. These imagined numbers are just used to make a point, that *Fonterra's* improving margins may well offset partially or in full the reduction in value of farms and herds. Disruption on a major scale would leave non-shareholder farmers, many sharemilker's and farmers who supply corporate milk companies, obliterated. If the executive of *Fonterra* are as dismissive of Synthetic Milk as their R&D Director and Minister Guy, then time will tell if that amounts to gross negligence or steady handed management in the face of a materialising threat.

Another example of Synthetic Foods being discussed in Animal Agriculture has been by the farming media where Jamie MacKay, host of *The Country* radio show asks his guest Don Carson (MacKay, 2016):

JM - Hey what do you make of the comments from the controversial Blogger, if I can call her that, Rachel Stewart who said we'll be drinking synthetic milk in 5 years and no one will be eating meat in ten years, what a load of hogwash.

DC - oh a lot of rubbish, I can't believe that and I don't think anyone would anyway.

JM - Ok, Theo Spierings is one of the other big stories of the week, should he stay or should he go?

While Stewart is mentioned as a member of the media that seems convinced of Milk Without Cows diffusion, the promotional farming media are less so and dedicate a whole 13 seconds to dismiss the potentially devastating and therefore important subject. This question and its answer were sandwiched between a discussion on the likely milk payout rise from a historic low and whether the CEO of *Fonterra* should stay or go. It is fairly safe to conclude that the Agrifood Assemblage has not been meaningfully engaged on the subject of Synthetic Foods, at least not publically so. Potential readings of these circumstances might be that this neglect is to avoid the painful consideration of a

potentially catastrophic disruption, or that there is no appetite for knowledge on the subject because it seems unbelievable, or that powerful stakeholders are directing the conversation purposefully away from the subject so as not to contribute to its performative manifestation into a market becoming actual.

The importance of speculative reading is that it helps to broaden an awareness of all the explanatory possibilities which might make meaning of what is happening in and around the market for Synthetic Foods. Location of the market makes a difference to how the market evolves and this is potentially so with Synthetic Foods whose market is most likely to be located in areas of burgeoning middle class populations. The work of disassembling Animal Agriculture's cultural claims to naturalness is made through direct economic confrontation such as Cultured Meat replacing conventional meat, but also through indirect attacks by the likes of Synthetic Leather. To assemble Synthetic Foods instead, The Movement exhibits an interconnectedness that turbo charges the process although there are internal inconsistencies which gives pause to the level of uniformity in which some relations are bound. Finally, the speculations as to why Animal Agriculture actors seem so dismissive of this technology will have to suffice until a more detailed piece of research explicitly asks the questions on what Animal Agriculture is thinking and doing in response, if anything.

6.3 Future Study

Because the study of this Synthetic Foods Assemblage is necessarily one sided to fit into the confines of a thesis then it is important that further studies balance this out by presenting other views within the contest and to investigate The Movement in more depth. New studies might endeavour to gather information on what is thought about the Synthetic Foods market from actors within Animal Agriculture, who are most obviously farming institutions or less obviously support services and political actors. Although engaging on the subject might be seen as legitimising the threat, attempts to academically engage the other side of the Synthetic Foods debate is needed because insights gained might help explain some differences in thought regarding how markets are assembled. Even a refusal to engage with the subject of Synthetic Foods might reveal much on how Animal Agriculture, as a cultural artefact, thinks about potentially disruptive futures such as that offered by Synthetic Foods.

Studies like this might ignite a rethink on how the multifarious actors of Animal Agriculture can mitigate the economic and societal impacts of being culturally disassembled by a new market, fuelled by new innovations. Ethically, further studies might have to grapple with the potential

impacts of this ignition such as the unintentional promotion of a market that becomes self-actualising through the very performance of studying and discussing it. Actors not immediately visible to the Animal Agriculture supply chain might also be engaged in order to reveal how a market for Synthetic Foods is being conceived. Financial institutions which hold billions of dollars in mortgages over agricultural property are one such example of an Assemblage that is adhered to Animal Agriculture and therefore might have some interesting insights into how future risks to current markets might be assessed.

Investigation of what political actors think is advisable, seeing as they are theoretically charged with keeping nation states stable and progressive. The primacy of economic interests in neoliberal political economies, means that threats and opportunities arising from the becoming of new markets is of political importance. The workings of government can be made clearer when political actors responses are illuminated and also the investigation itself may ignite action to prepare for and mitigate potential societal change. For instance, what might a quicker than expected population flight from rural areas mean for urban support services, if farms become unproductive assets? The academic study of this market might be valuable for the sake of knowledge but in addition it could be seen as valuable if it helps societal actors pre-empt a future that could arrive, could arrive sooner than thought and could have society transforming consequences.

This thesis has re-represented the arguments from The Movement and offered an analysis of some themes, therefore a more in depth method of research focussed on The Movement could assist in understanding the creation of markets and in particular the market for Synthetic Foods. What is said and transmitted for consumption is one thing but the practices of The Movement are another. This necessitates a range of other methodological techniques such as in-depth interviews, ethnographic research and participant observation to uncover their 'doings and well as sayings' within The Movement (Evans, 2012, p. 43). There are multiple approaches for carrying on the work of studying the markets for Synthetic Foods including collecting thoughts from Synthetic Foods, Animal Agriculture, Animal Agriculture's support services and the political actors of the day, as well as an expanded analysis of The Movement to more fully appreciate the thoughts which are contained here.

6.4 Epilogue

This thesis ties production and consumption together to show how markets are being made for Synthetic Foods. The spaces of consumption and production can bring an understanding of how

identity is negotiated and how practices evolve. Rather than producers being capitalist machines and consumers being Baudrillian dupes, each can be seen as multifariously complex entities that operate within ethical and moral spaces. While the producers of Synthetic Foods construct arguments to give meaning to their future products, it is the consumers of this information and the potential consumers of products which have yet to reveal in which way this market will manifest, if at all. This helps to explain how markets are made through co-constructed relational meanings in exchanges between producers and consumers that bring markets about in particular ways.

The discursive spaces of institutions like The Movement, can be considered using Foucauldian Discourses and the notion of Assemblages can be put to work in helping us to understand what is happening outside of the institutional spaces, in the relational spaces of a networked market. Rather than fear the complexity of relational spaces which continually problematises spatial ordering and therefore problematises what we know, what we thought and what we thought we knew, relational spaces such as that of an assembled market for Synthetic Foods is an exciting spatial prospect precisely because of the multiple ways in which space, time and place can be interpreted. This way of thinking about market geographies portrays a poststructural world of multiple and contingent truths which adds to the weight of geographic knowledge. What Geography is, what markets are, what Synthetic Foods are, what Animal Agriculture is, what we are and what we know are not set in stone, these are negotiable and contingent...just like me...I think. What do you think?

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