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FOR AN ECHOLOGY OF MICROBE-ARTWORKS:
THINKING IN BETWEEN ART AND SCIENCE

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Cette thèse intitulée
For An Echology of Microbe-Artworks: Thinking In Between Art and Science

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Résumé

Une entité scientifique, tout en ayant son propre devenir dans le domaine scientifique, s'étend aussi souvent à d'autres domaines d'activité. Parallèlement à la diffusion des découvertes scientifiques, elle peut susciter un intérêt artistique ou conceptuel. Les études sur le microbiome humain ont nourri un tel intérêt pour les microbes et ont encouragé de nombreux artistes à entrer dans un laboratoire de biologie et à produire des œuvres artistiques avec et à travers les microbes. Ces œuvres d'art établissent une relation étroite avec les découvertes scientifiques récentes, les procédures et les protocoles, et posent des questions philosophiques sur la vie et la mort, la nature, l'humanité, et les relations entre les êtres vivants. Cette thèse vise à examiner les processus sociaux, techniques, politiques et économiques qui traversent les sciences des microbes et à déterminer comment ils aboutissent dans les œuvres d'Elaine Whittaker, Tarsh Bates, François-Joseph Lapointe, Günes-Helen Isitan, le collectif Interspecifics, Victoria Shennan, Saša Spačal, Sonja Bäumel, Raphael Kim et Kathy High.

Lorsque nous trouvons un microbe dans un contexte particulier, que trouvons-nous d'autre avec lui ? Dans quelles conditions apparaît-il dans une œuvre d'art et avec quels éléments l'œuvre compose-t-elle pour produire des effets esthétiques ? Dans cette thèse, l'histoire des microbes considérée du point de vue des formes d'art les mobilisant (ou « microbe-œuvres d'art » pour *microbe-artworks*) commence en fait avec des *animalcules* qui n'étaient pas encore des entités scientifiques à part entière, mais qui présentaient virtuellement les forces qui seraient réunies plus tard sous le terme scientifique de « microbe ». Dans un premier temps, les animalcules, nommés après des observations d'Antonie von Leeuwenhoek, ont suscité l'intérêt de philosophes comme Leibniz et Spinoza et intensifié la curiosité de peintres comme Johannes Vermeer pour les éléments microscopiques de la vision, initiant ainsi des voyages entre les champs scientifiques et artistiques.

Cette étude propose de problématiser ces voyages à l'aide du concept d'« échologie », un terme oublié d'une thèse écrite dans les années 1970 par Jean Milet sur la sociologie de Gabriel Tarde. Mais les théories d'autres philosophes tels que Georges Canguilhem, Michel Foucault, Gilles Deleuze, Félix Guattari, Marie-José Mondzain, et Gilbert Simondon, et des penseurs contemporains tels que Thierry Bardini et Brian Massumi sont également mobilisées pour donner à ce terme toute sa cohérence. Selon l'échologie, les entités sont constituées des motifs (*patterns*) d'interférence et de résonance avec d'autres choses, qui précèdent leur représentation. Ainsi, une

entité donnée est un complexe de forces, et son apparition, le résultat de certaines techniques qui la mettent en relation avec d'autres complexes ne peut s'expliquer comme un effet associé à une seule cause, mais se donne comme un effet supplémentaire, un extra-effet ou un surplus qui laisse toujours une trace ou un résidu. D'un point de vue écolologique, une *microbe-œuvre* d'art s'opère comme une interface qui intègre des potentiels qui se rendent visibles à travers les traces en vertu de multiples processus recoupant les activités scientifiques et les stratégies artistiques.

Chaque chapitre de la thèse est ainsi une étape dans un voyage conceptuel expérimental, révélant les dimensions des œuvres d'art considérées au regard de l'analyse de ces traces. Au cours de ce voyage, les éléments des théories scientifiques concernées, des entretiens avec des artistes, des sorties sur des sites de pratique des arts biologiques, lors d'ateliers, de conférence et d'écoles d'été sont mobilisés comme facteurs contribuant à la construction des champs problématiques dans chaque chapitre. Les microbes considérés comme des objets de beauté apparaissent comme le résultat d'une transformation discursive des sciences biologiques. D'une conception pathogène des microbes aux approches écologiques, l'iconicité des microbes associés aux *microbe-images*, l'échologie des *microbe-sons*, le devenir-milieu de certaines *microbe-œuvres* d'art, et enfin la question de l'individuation de la pensée, et l'éthique corrélée compris comme le problème de la valorisation des microbes dans des *microbe-œuvres* d'art, le devenir-microbe découle de cette transformation discursive à travers le champ artistique.

Mots clés : arts et sciences, écologie, échologie, études du microbiome, microbe, bioart, pensée, éthique.

Abstract

A scientific entity, while having its own becoming in the scientific field, often also spreads to other fields of activity, such as art and philosophy. Microbiome studies fed such an interest towards microbes and encouraged many artists to enter a biology laboratory and produce a work of art with and through microbes. These artworks establish a close relationship with recent scientific findings, procedures and protocols, and ask philosophical questions about life and death, nature, humanness, and the relationships between living beings. This thesis aims to examine the social, technical, political, and economic processes that go through the microbe sciences and determine how they come together in the artworks of Elaine Whittaker, Tarsh Bates, François-Joseph Lapointe, Günes-Helen Isitan, the collective *Interspecifics*, Victoria Shennan, Saša Spačal, Sonja Bäümel, Raphael Kim, and Kathy High.

When we find a microbe in a particular context, what else do we find with it? Under which conditions does it appear in an artwork and which elements does the artwork compose with to produce aesthetic effects? In this thesis, the story of microbes is recounted from the perspective of microbe-artworks and starts with animalcules, the not yet full-fledged scientific entity which virtually present the forces that would be brought together under the scientific term “microbe”. At first, animalcules—named after Antonie van Leeuwenhoek’s observations, attracted the interest of philosophers such as Leibniz and Spinoza and intensified the curiosity of painters such as Johannes Vermeer towards the microscopic elements of seeing, hereby initiating journeys between scientific and artistic fields.

This study proposes to problematize these journeys as an “echology”. Echology is a forgotten term first introduced in the ‘70s by Jean Milet in his thesis about the sociology of Gabriel Tarde. Here, the theories of other philosophers such as Georges Canguilhem, Michel Foucault, Gilles Deleuze, Félix Guattari, Marie-José Mondzain, Gilbert Simondon, and contemporary thinkers such as Thierry Bardini and Brian Massumi are mobilized in order to give this term its full consistency. According to echology, entities consist of patterns of interference and resonance with other things, which arise before their representation. Thus, a given entity is a complex of forces and its apparition the result of certain techniques which put it into relation with other complexes cannot be explained as an effect associated with a single cause but gives itself as an extra-effect or surplus that always leaves a remainder. From an ecological perspective, a microbe-

artwork operates as an interface that incorporates potentials that make themselves visible through the remainders by virtue of multiple processes cutting across scientific activities and artistic strategies.

Each chapter of the thesis is thus a way station in a conceptual journey of experimentation, revealing the dimensions of the artworks under consideration with respect to the analysis of these remainders. During this journey, elements of scientific theories, interviews with artists, field trips to sites of practice of the biological arts, related workshops and summer schools are mobilized as contributory factors of the construction of the problematic fields in each chapter. Microbes considered as objects of beauty hence appear as the result of discursive transformation of biological sciences. From earlier pathogenic conceptions of microbes to contemporary ecological approaches, the iconicity of microbes associated with microbe-images, echology of microbe-sounds, becoming-milieu of certain microbe-artworks, and finally, the question of individuation of thought and the correlated ethics understood as the problem of valuation of microbe-artworks, the becoming-microbe stems from this discursive transformation through the art field.

Keywords: arts and sciences, ecology, echology, microbiome studies, microbe, bioart, thinking, ethics.

Contents

Résumé	4
Abstract	6
Acknowledgments	13
Introduction: On the Trail of a Research Agenda.	16
<i>Bioart</i>	17
Arriving at Microbes.	18
Question of Method.	20
Ethnographic Sensibilities.	21
Artistic Sensibilities.	23
Immanent Critique.	26
Chapters: Jumping in a Field of Uncertainties.	29
0. Actuality and Us.	43
Chapter 1. From Animalcules to Microbe-Artworks: Echoing Science, Philosophy, And Art	45
1.1. The Beginning of the Adventure of Microbes: Animalcules	47
1.2. Life Squeezed into a Drop of Water.	48
1.3. Animalcules and Leibniz	51
1.4. Seeing and/or Thinking Animalcules	53
1.5. The Problem of Problem	56
1.6. For an <i>Echology</i> of Animalcules: Tarde's Contribution	59
1.7. Spinoza's <i>Ethics</i> on the Worm in the Blood	64

1.8. How To Interpret a Work of Art: Or the Ungraspability of Vermeer’s Paintings . .	69
1.9. For an Echology of...	76
Chapter 2. Before the World Collapses: A Microbe-Aesthetics	79
2.1. Microbes: Death, Disaster, and Fear?	81
2.1.1. The Complexity of Pathogenicity of Microbes: The Concept of Milieu . .	84
2.1.2. Microbe Enters the Clinics	90
2.1.2.1. A Region Where Things and Words Are Not Separated	91
2.1.2.2. A Conception of Disease Based on Species	93
2.1.2.3. Disease as An Event: Towards a Pathological Anatomy	98
2.1.2.4. Thickness of Body, Illuminating Gaze of Death	102
2.1.3. In the Trajectories of Epidemics	107
2.1.3.1. Transformation of Power Diagrams and the Unfolding of an Outside	109
2.1.3.2. Thinking from Outside	116
2.2. A Microbe-Aesthetics	124
2.2.1. From Aesthetic Judgement to Becoming	125
2.3. An Echology of Elaine Whittaker’s Work	130
Chapter 3. Performing <i>The Unsettling Eros of Contact Zones</i> : Microbe-Ecologies	135
3.1. Revisiting the Immunologies	139
3.1.1. Elie Metchnikoff’s Contributions to Immune Theory	141
3.1.2. Towards a Scientific Notion of Immune Self: Frank Macfarlane Burnet. .	144
3.1.3. Ecology in Sciences (and Beyond)	146
3.1.4. An Expanded Field of Immunology with Donna Haraway	150
3.2. Taking Care of Microorganisms: Science and Art ScienceandArt scienceandart . .	154
3.2.1. Aesthetics of Care	156
3.2.2. The Ethical-Aesthetical Ecologies of <i>The Unsettling Eros of Contact Zones</i>	160
3.3. Conclusion	165

Chapter 4. What Do We See When We See Microbe-Images?	167
4.1. The Economy of Microbe-Images	171
4.2. Günes-Helen Isitan’s <i>Hybridities: Almost Other</i>	173
4.2.1. Doing with Science	177
4.2.1.2. Photographing Microbes Alongside the Human Face	180
4.2.1.3. Photography as an Apparatus.	180
4.2.1.4. Whose Face?	182
4.2.1.5. Dismantling the Face	184
4.3. Portraying the Microbes: François-Joseph Lapointe’s Artistic Experiments	187
4.3.1. At the Intersection of the Social and Biological	188
4.3.1.2. <i>Microbiome Selfies</i>	189
4.3.1.3. The Iconic Enigma of Life Sciences: The Idea of Co-Development	192
4.3.1.4. A Metagenomic Economy of Art	194
4.4. The Calling of Microbe-Images	199
Chapter 5. What Do We Hear When We Hear Microbes-Sounds?	207
5.1. The Question of Microbe-Sounds	208
5.2. Navigating the Rhythms	212
5.3. Biological Rhythms	214
5.4. Milieux and Rhythms	216
5.5. The Music of Life	219
5.6. <i>Interspecifics</i> Collective	221
5.7. <i>the dark side of the cells</i> : Cellular Noise or Cellular Music?	225
5.8. The Refrain of Microbe-Sounds	228

5.8.1. Günes-Helen Isitan’s Microbiota’s Song	230
5.8.2. Vicki Shennan’s <i>Anthropocene</i>	231
5.9. Echoing Microbe-Sounds	234
Chapter 6. What Do We Experience With Microbe-Milieux?	237
6.1. The Milieu of Symbioses with Microbes	238
6.2. The Art of Human-Microbe Symbiosis: The Work of Saša Spačal	241
6.2.1. On the Tracks of Gilbert Simondon’s Crab and Anemone	243
6.2.2. Economy of Symbiosis	245
6.3. Experiencing Microbe-Milieux in Sonja Bäumel’s Work	246
6.3.1. Microbial Communication: Sense and Viscera	247
6.3.2. <i>Being Encounter</i>	249
6.4. Individuation of Thinking	250
6.4.1. Thinking of the Crab-Anemone Symbiosis	251
6.4.2. Workshops	253
6.4.3. <i>Immortality</i> Workshop with Marta de Menezes	254
6.4.4. Thinking With Microbe-Artworks	256
6.4.5. The Non-Reviewability of Thierry Bardini’s <i>Junkware</i> or the Bardini Effect	258
6.5. For A Microbe-Ethics	262
Chapter 7. The Valuation of Microbes: For A Microbe-Ethics	264
7.1. Microbe-Artworks	270
7.2. Microbial Currency: Raphael Kim	271

7.2.1. Microbes as Living Currency	272
7.2.3. Currency Becomes Money: Microbial Money	275
7.2.4. Financialization of Microbes	276
7.2.5. Circulating Microbial Money: <i>Peck As You Go</i>	280
7.3. The Promise of Microbes: <i>You Are My Future</i> by Kathy High	284
7.3.1. A Step Back: <i>Embracing Animal</i>	285
7.3.2. The Paradox of Abject	287
7.3.3. From Abject to Object: Abject Object	290
7.3.4. Art’s Wandering in the Cracks of Sciences.	294
7.3.5. At the Edge of Death, Towards Life, And Its Beyond	298
1. Hearing the Inactual	303
Conclusion: Inside Out Envelope—Uncharted Realms of Microbe-Artworks. . .	305
The Journey of Echologist	305
The Ethics of Microbe-Artworks, an Echological Writing	309
The Future Claim of Echology	312
Bibliography	316

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My dialogue with Kath High at the *Society for Literature, Science, and the Arts* conference held at Rice University in Houston continued with my participation in the opening of her exhibition "Gut Love" at Esther Gallery in Philadelphia and played an important role in shaping this project. Marta de Menezes somehow affected my decision to work in this field, probably without even knowing, with the workshops she gave in Montreal and the *Cultivamos Cultura* summer school/residency she hosted in Portugal.

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Alex, Clara, Medy, Sarah, and Philippe allowed me to get to know the field of communication through our exciting discussions. Thanks to them, I was better able to familiarize myself with the intellectual climate of Montreal and the discipline of Communication Studies. The second-generation members, Agathe, Ricardo, Kevin, and Lorène continued this ambiance with their precious personal contributions.

Again, the reading groups organized by *Sense Lab* were an event, a breath of fresh air in my life.

Before I came to Montreal, Brian Massumi was a conceptual persona for me. It is not an exaggeration to say that the excitement I felt reading his texts were what brought me to Montreal. Reading him is like a wind pushing you from behind. But meeting him in Montreal only increased this excitement more. Every encounter with Brian was an event similar to what Deleuze said of Foucault: an atmospheric change, entering an electric or magnetic field.

While Agathe François constantly reminded me of non-academic excitements, the excitement of intellectual debates with Ricardo Vidal was enough for us to lose our sense of orientation in Montreal's small subway over and over again. Ricardo and Caroline displayed the best of friendship to me during my stay in Montreal.

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The walks Marina and I took were not just a walk. It was a stopping moment in the already beaten paths of the world: an ethics of walking. The acts of generosity, care, and love that followed every walk were like the outlines of a collective resistance against the voracity of neoliberal capitalism and the exclusionary mechanism of racism that await at every corner. Montreal would have been a much more unbearable place for me without Marina, that's for sure!

Marianna Milhorat entered my life at maybe the most pessimistic, depressive period of my life in Montreal. Perhaps we met with her in silence since she is not a human being, but a panoply of animals. There was always a certain lightness between us, and in the end, it always turned into joy. I discovered the meaning of silence with her.

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* * *

I do not attach great importance to this thesis and I see it as the natural extension of the flow of life. But still, I would like to playfully write for earth; animals, mountains, plants, microorganisms, and so on. Not by speaking for them or reducing them to metaphorical figures in writing but for the pure lines of a becoming-earth.

Introduction: On the Trail of a Research Agenda

It is difficult to predict exactly when the writing process of this dissertation began. I guess my interest in the research topics, namely the relationship between science, art, and philosophy should have predated even my master thesis. I do remember that my interest in biology sharpened during this period. In my master thesis, I compared certain aspects of Michel Foucault's archeology in terms of the linguistic statements couched in discursive formations with certain aspects of the school of pragmatism of the philosophy of language (through Austin and Searle). In this study, Foucault's *Les mot et les choses* (1966) occupied an important place for me. Foucault cites life sciences, political economy, and linguistics as the three main pillars of Western knowledge which he calls the modern *épistémé*. While Foucault deals with biology through an epistemological framework here, in his later work he would place it in the context of the formation of power relations. This was very interesting to me at that time.

The fact that a field which concerns itself with explaining living beings' modes of operation played a dominant role in the governance of masses was very interesting to me. What's more, this was happening without us even noticing. Biological processes sustaining the fact of being alive were, in various ways, becoming part of the apparatuses of governance. Biology was an ever-evolving field, and I started to see how the subfields arising from its expansion had profound effects on how we perceive the world, nature, and life: epigenetics, stem cell research, bioinformatics, etc. On the other hand, the following question was somehow always in the background for me: what was the relationship of all these new fields to power formations? Thus, my relationship with biology evolved in two directions: contemporary biopolitical research agenda and science and technology studies.

In another vein, after my master thesis, I started to focus on the readings of Gilles Deleuze. The way he made biological references a part of the conceptual toolbox in *Différence et répétition* (1968) was impressive to me. In *Mille Plateaux* (1980), co-authored with Félix Guattari, biology turned into a stunning conceptual production: rhizome, becoming, refrain, etc. Therefore, a bifurcation that developed on a Foucauldian frame now turned into a much more fundamental ramification. On the one side, there were biological processes, structures, and objects composing

power formations; on the other, the conceptual relationship with those processes was being established in a more “affirmative” manner, and beyond that even, the processes of becoming entered with/through them. So, from the very beginning, it was this tension that I wanted to work in as part of a doctoral project. Through biology, I wanted to understand something that I have always been aware of but could not state in thinking and language: “unconscious is subtlety!”

At this level, however, the field was enormously wide. Both Foucauldian and Deleuzian literatures had become more detailed and the life sciences were an infinitely expanding field, so much so that it was becoming increasingly difficult for an avid amateur to follow. So, I decided to do the necessary narrowing down by focusing on a specific area of biology. The first subject that entered my agenda was stem cell research. Pluripotent stem cells’ capacity to transform into all cell types was the first thing to draw my attention, a potential that might invoke the context of *Difference and Repetition*. The idea that repetition is always of difference seemed, to me, relevant to stem cell research and might pave the way for philosophical elaboration. Furthermore, it was also not difficult to see the implications of stem cell research in institutions and power formations. Although the incredible potential of pluripotent cells was promising in the treatment of many diseases, the question of how this promise would be realized in institutions was producing problematic situations.

Bioart

Nevertheless, it would not be easy to think these two things together and required great intellectual agility (an agility I probably did not have), as well as a closer understanding of stem cell research and how it is based in institutions and comes into contact with them. While I was looking for a strategy to bypass these difficulties, I came across a field called “bioart” where I can say I actually found almost everything I was looking for. Here was a field where artists produced artwork using the possibilities of biological laboratories, making certain implicit questions pertaining to biology visible and preparing the basis for an “affective”, “perceptive” relationship with biological systems, processes, and entities. The context of biopolitics was not far either. Many artists working in the field were aware of these discussions and were, in one way or another, including them in their work. So, I started to concentrate my research on artists interested in stem cells. In the first year of my doctoral study at the Department of Communication, University of

Montreal I made a presentation at the *Society for Literature, Science, and the Arts* (SLSA) conference held in Houston. In this presentation, through Guy-Ben Ary's artwork *In Potentia*, I tried to mobilize Deleuze's concept of the virtual to analyze the various dimensions traversing Ary's work. Although this presentation was an important exercise for my thinking of bioartistic practices through a philosophical stance, I was soon convinced that I could not further my work by staying in the stem cell context. Artists working with stem cells were few and the institutional and scientific difficulties I mentioned earlier were insurmountable.

Meanwhile, I was continuing to follow doctoral seminars in Montreal and attending workshops at various universities. In one such workshop, I listened to Marta de Menezes' presentation on art projects developed in relation to the microbiome research field. This field immediately caught my attention and I soon started my research about it. Interestingly, at the same time, I became aware of the existence of Montreal-based artists in the field: Günes-Helen Isitan, Whitefeather Hunter, and François-Joseph Lapointe. Thus, I started to expand the repertoire of artworks produced in the field and research the field of microbiome-research where the artists were inspired or working in person. Questions started to pile up. What drew the artists to such a field? What were they aiming to do in their work? What motivated them to enter the biological laboratory? What kind of scientific field was this?

Arriving at Microbes

The creatures we associate with disease-causing factors had gained an affirmative aspect and it was revealed that they had important roles in matters of our relationship with nature and functioning of the human body. The *Human Microbiome Project*, especially, has been a breakthrough in our approach to microorganisms and has a foothold in new approaches to the functioning of natural processes. We were now learning how fascinating microorganisms are as creatures, that they have complex relationships with nature and living beings.

The most decisive aspect of my approach to this field, therefore, was the historicity of the term "microbe" on which microbiome-research is based but distinguishes itself as a separate paradigm through different research agendas of fields such as microbiome-research, microbiology, immunology, and ecology. Nevertheless, the same creatures could also be fatal under other

conditions, and in epidemic situations, could lead to great destruction at different scales. So, I decided to insist on the term “microbe” in a somewhat provocative way in order to maintain this seemingly contradictory aspect. Microbe originally means microscopic organism but has historically been defined as a disease-causing microorganism in certain contexts.

However, things were complicated on the art side as well. Artists were studying biology theories, collaborating with scientists by entering the biological laboratory, but eventually, doing something different than the scientists do. What was this difference? How did this difference come to light? What was their relationship with the conditions, scientific motives, protocols, and practices that revealed it? These questions could, of course, be considered in conjunction with areas such as performative art, media art, or the other veins of history of art¹. The fact that the works derived from biological discourses and practices connected them to the genealogy of the whole field of biology and the resulting effects themselves became a question. In a sense, the popular theories at use at that time in North America such as speculative realism or object-oriented ontology were unable to apprehend these effects and respond to the complexity of the field. Whenever ready-made concepts are applied in the field, art and science are substantiated as pre-given “domains”.

The research I made in the field of microbiome studies and the interviews I conducted with artists working in this field taught me that both scientific progress and artistic production include creativity in one way or another. This share of creativity in different activities could not be covered under the pre-delineated domains of “art” or “science”. And when it comes to microbes, what the sciences show us is that there is a coming out of something that constantly surprises us. I decided to pursue this capacity of astonishment and investigate the manifestations of this surprise, the becoming of its forms in whichever field they were planted. Instead of assuming domains that were previously separated as science and art, I decided to conceive them through a process of formation that makes them separate but *somehow* related activities.

* * *

¹ See, for example: Goldberg, R. & Anderson, L. (1998). *Performance: Live art since 1960*. Harry N. Abrams Publishers.

In fact, I had fragmentary pieces at hand rather than a clear-cut research program: cluttered questions, vague, mostly intuitive relationships with some philosophies, conversations with artists and scientists on the run. So, I started a two-way research process to follow this research impulse. On the one hand, I approached the field and entered environments where I could work with artists and observe laboratory processes. On the other, I followed the pathogenic-microbe/useful-microbe tension I felt, which was quite essential in the constitution of the field. Before moving on to how the research process continued and shaped the organization of this thesis, it would be important to, at this point, address questions pertaining to method and methodology. Since the research until this point process had been carried out with hesitations and many directional changes, it turned out to be exactly a problem of methodology.

A Question of Method

I begin with the second passage, but break off in the middle and turn into the third passage and let it take me back again to the Castle Keep, and now of course I have to begin at the second passage once more, and so I play with my task and lengthen it out and smile to myself and enjoy myself and become quite dazed with all the work in front of me, but never think of turning aside from it.

Kafka, *The Burrow*

When you make wonder itself the main element of a study in relation to the interaction between sciences and arts, abundant situations on both sides await you. Yet, it is not clear how these can be studied. Science and Technology Studies (STS) have a wide range of concepts and a research program available for the study of the implication of different practices in the organization of the biological laboratory and its impacts in the wider social environment². Meanwhile, when the body

² Laboratory studies put all these dimensions into question. They attempt to show that even the most trivial activity like chitchatting or fulfilling a simple, already determined task can have an impact on the scientific mode of knowledge production. For the importance of talking as thinking, see, Amann, K. & Cetina, K.K. (1998). "Thinking Through Talk: An Ethnographical Study of a Molecular Biology Laboratory", *Knowledge and Society* 8, pp. 3-26. For a more extensive study that also discusses the epistemological issues through the contingencies in scientific laboratories, see, Knorr-Cetina (1999). Actor-Network Theory scholars have also demonstrated the moments dualities' collapse of dualities in laboratory practices. For example, see, Woolgar, S., & Latour, B. (1986). *Laboratory life: the construction of scientific facts*.

gained a privileged place in the history of art in the 20th century, this resulted in a different artistic agenda. Futurists and Dadaist performances (among others) challenged the boundaries of existing artistic methodologies which now required collaboration with fields such as sociology, anthropology, philosophy, and even emerging STS fields³. Different art forms such as performance-based installations, interactive art, or new media art brought with them the use of different media, embodying different corporeal relations. An artist's engagement with biotechnology and life sciences can be considered in the same vein. Biotechnologies or biological systems and entities, in general, present for artists a receptive medium for the blossoming of projects and approaches, dealing with problematics calling corporeal identities into question. Art at the interface of the organic and the mechanical now finds itself confronted with concrete living entities.

Ethnographic Sensibilities

Authors such as Robert Mitchell and Jens Hauser emphasize that “bioart” works⁴, produced in connection with biology, play a sensorial or affective role in revealing the invisible aspects of life and living beings. Beyond metaphorical use, biological discourses, systems, practices, protocols, and techniques become part of artistic expression. A work of bioart creates an

Princeton University Press. All these works presented me with preliminary insights into the complexity and ramifications of the laboratory environment.

³ From the '60s on, different artistic forms that hadn't existed before began to emerge; for example, the anthropometries of Yves Klein, the use of human excrement in installations by Piero Manzoni, body interventions from scarifications to mutilations, or feminist performances that investigate and push what a body can do. Art movements like Fluxus, Conceptual Art, and Situationism blur the boundaries between art and life by combining their practices with a critique of prevalent institutions (Kaprow, 2003).

⁴ Actually, giving a name to this kind of artwork is more problematic than it seems. Semi-living art (Oron Catts & Ionat Zurr) genetic art (Joe Davis), and transgenic art (Eduardo Kac), are only a few examples of the propositions that have been made. Discussions about these terms can be found in: Suzanne Anker and Dorothy Nelkin, 2004; Patricia Solini, Jens Hauser, and Vilém Flusser, 2003; and Eduardo Kac, 2007. Robert Mitchell's distinction between “prophylactic art” that uses traditional media and “vitalist bioart” that uses biological media is helpful, but not sufficient in capturing the extensive variety of works produced in this field. See, Mitchell, R. (2010). *Bioart and the vitality of media*. Seattle/London: University of Washington Press. In the same book, Mitchell proposes the use of the problematic as a concept to categorize biological artworks, which I find more useful than other propositions.

“embodied sense” in the gallery-goers (Mitchell, 2010, p. 11) through which a gallery-goer “sensually or multi-sensorially accomplishes an affective visualization of a corporeal projection” (Hauser, 2006, p. 132). These works are not based on a linear process of production in a single site but are composed by many elements and factors. This makes ethnographic approaches important in studying bioart works and requires an ethnographic sensibility for studying the multi-sited, multi-species interactions.

Artists use biotechnological possibilities and engage with biological laboratory practices for creative purposes, transforming potentials of life sciences into artistic expressions. Many contemporary thinkers have already pointed out these potentials. Life sciences’ findings invite us to rethink the relationship with living beings, nature, and even the universe. In Rosi Braidotti’s account, for example, new modes of affectivity and interconnection displace the centrality of human life in favor of a “trans-species egalitarianism” (Braidotti, 2006, p. 267). These modes are also the germs of new types of subjectivities that could be possible in the future. Meanwhile, Anna Tsing suggests that “human nature is an interspecies relationship” (Tsing, 2012; see also Haraway, 2008, p.19). Engaging with life sciences in a philosophical stance involves a reassessment of existing modes of relationship, or even the rebirth of new ones, for example, in Donna Haraway’s influential account of “contact zones” with “companion species” (2008). Vinciant Despret brings together philosophy, ethnology, and ethology in an original way to discuss the possibility of an “animal language” or even an animal poetry that cannot be reduced to the preordained meanings of human culture (2016). All these accounts inform the artists’ practice in one way or another. Bioart thus appears as a separate field, one investigating modes of relationship with life and living beings, experimenting with different units of biological life, tissues, cells, and even molecules.

As such, research conducted in the field of bioart needs to be flexible enough to accommodate the diverse and experimental character of the works. The first methodological tool that came to mind was “multispecies ethnography”, which studies the interactions among multiple elements of interactions between different species (Descola, 2013; Kohn, 2013; Kirskey, 2014; Kirksey and Helmreich, 2010). Multi-species ethnography proposes that an ethnographical field is populated with nonhuman beings and thus shifts the focus away from an internal analysis of social conventions and institutions towards an analysis of the interactions among humans, biological entities, technological procedures, physical processes, artifacts, images, and other forms

of documentations. Multi-species ethnography focuses on the zones of encounter between human beings and other beings in mutual ecologies (Kirksey, 2014). The term “multispecies” already travels in biological and ecological research environments, referring to patterns of multispecies interactions, co-construction of niches, and ecological life (De Ruiter et al., 2005). Multispecies ethnography turns out to have aspects in common with multi-sited ethnography (Marcus, 1995). Multispecies ethnographers follow genes, cells, and organisms across landscapes and laboratories (Kelley & Harward, 2013).

All these different elements of ethnographic methods were involved in this project within the scope of included artworks. It is difficult to say, however, if any methodology in question had a central or guiding role in the organization of this thesis. Rather, sayings and doings, their temporal flow, the interactional patterns performed by artistic practices, incorporation of different devices such as digital imagining, bioinformatics or visualization of data, the horizon of meanings, intelligibility, or affective/ethical dispositions such as concern and care within which artistic expressions unfold, and the active contribution of artefacts all constituted ethnographic sensibilities (Neyland, 2008) in relation with the artworks concerned.

Artistic Sensibilities

The ethnographic sensibilities at work in this thesis were extended into various forms of engagement with the artworks and environments through which they were produced. I visited biological laboratories in which artists work and collaborate with scientists, participated in related summer schools, conferences, and workshops, and finally, conducted semi-structured or spontaneous interviews with artists, curators, and scientists. All these environments implicitly or explicitly composed the texture of this thesis in one way or another. My participation in the *Cultivamos Cultura Summer School* that took place in the summer of 2016 in a small village of São Luís, Portugal and my visit to the *Coalesce* bioart laboratory at University of Buffalo were especially crucial. They informed my decision to work on microbe-related art projects and develop this thesis towards the suggested methodology (or lack of it) in studying the relationship between art and science.

In *Cultivamos Cultura Summer School*, the main focus of that summer was working with bacteria. It was my first contact with microorganisms and the procedures for using, manipulating, transforming, and at the end, experimenting with them. Some artists already had experience working with bacteria and some cultural theorists of using them in their analysis. Although there were many events, ideas, situations, and propositions circulating in the air, at the end of the summer school, we were not able to collectively produce an artwork that could be exhibited in an art gallery. The technical tools were there to reveal and experiment with biological culture. We put different colored paints together with different kinds of bacteria sampled from the environment and quilts with different shapes, textures, and patterns. But it never turned out to be a clear-cut idea that would produce an artistic expression. The necessary technical tools, collaboration with different disciplines, and even the access to a biological laboratory were not enough to produce a work of bioart. The relationship with a specific site was rather one of the work's problematic dimensions. How do artists negotiate with, transform, or are absorbed by features of the site of production? Which specific conditions are more favorable for the flourishing of interesting ideas? How do they arise and transform in the process of production?

At this point, I had already decided to study microbe-related artworks and to make the difficulties and uncertainties I faced in the above process as part of this project. From this point of view, my visit to the *Coalesce Bioart Lab* from May 4th to the 7th, 2018 also played a complementary role to the sensibilities obtained at the *Cultivamos Cultura Summer School*. Here, the interviews with *Coalesce* lab director and bioartist Paul Vanouse⁵ and evolutionary biologist Solon Morse, *Coalesce* lab manager, were particularly important to my understanding of how science and art come together in a specific project. What kind of ethos of collaboration between scientists and artists does the establishment of a biological laboratory dedicated solely to bioartistic creations produce? At the same time, the main purpose of this visit was to observe the development process of ongoing projects, to talk to the artists about the dimensions of their work, their presence in the laboratory within the scope of a project. During my time there, I had the opportunity to observe the production of various artworks such as: Günes-Helen Isitan's *Spill Your Guts*, Moria

⁵ See, for Paul Vanouse's own work, Vanouse (2007). "The Relative Velocity Inscription Device", in *Signs of Life*, ed. by Eduardo Kac, MIT Press.

Williams' *Fermented Freedom: Cultures of Preservation*, and Rian Hammond's *Open Source Gendercodes*.

Isitan's work, especially, was important to me in terms of her artistic approach to the symbiotic relationship between microbes and humans. The main idea behind Isitan's project was to obtain a microbial sound, the "song" of microbes with the use of electrophoresis gel slabs as punched cards for a child's music box. Isitan draws a parallel between human species, "homo sapiens" that represent a certain dot in the tree of evolution but are also a part of a network of interconnected species, and the music created between musical notes, which creates an effect that is more than the sum of its parts. In this sense, there is a *resonance* between human microbiota, which are diverse microbial communities of commensal, symbiotic, and pathogenic microorganisms and the environmental complexity that presents emergent properties. In this way, Isitan aimed to explore the multigenomic structure of homo sapiens in its entanglement with symbiotic microbes. The electrophoresis gel helped to translate the band patterns of each microorganism into a musical score for a music box. Each microbe and human DNA, when put together, created a unique "symphony", based on their microbiota⁶. But the process immediately came with uncertainties. Different types of DNA sequencing, resolution of various materials for the electrophoresis process, different growing nutrients, etc. would yield different results for the composition of the musical score at best, or simply not work and produce no results at the worst.

Thus, this visit brought various sensibilities to the structuring of this thesis in terms of the production of artworks. In a way, my initial feeling when starting this project was once again confirmed. Although both art and science take over certain methodologies, and techniques of production, neither of them are the activities whose criteria for reproduction are given from the outset. The process is open to negotiation, break, enablement, change of direction, or restarting. At this preliminary stage of the project, I also arrived at a fundamental discovery about the complicated skein of relationships, which has not yet gained full consistency, but which can still be called a "field". This discovery amounted to: failure is not a contingent, instantaneous state of the production process that can be remedied by an intervening idea given from the outset, bestowed with a force of correction, but is itself the constituent element.

⁶ Email exchange 21 April, 2018, personal communication 10 may, 2018.

In this respect, it can be said that the interaction between science and art goes through many phases. It passes from the primary phase of vague ideas to the production of a work where those ideas materialize, and eventually, end as something related to science but different from it, as “doing” something different. A work of art that emerges as a result of this process continues itself in the problematic character of artistic expression, unlike scientific activity which sustains itself in the forms, functions, and meanings in the recording surface of institutions. Hence, there is no unidimensional line of determination between science and art in favor of the first, but a resonance that creates a “field” of mutual influences. Some “biomedial” and “biopolitical” problems crystallize according to how the work under consideration is filtered through this process. Each chapter in the thesis is organized as an expression of such problems and their specific coming together in a field. For this, the experiences in the fields, which so far I have referred to as sensibilities, need to be transformed into a certain approach in order to gain consistency in a research program.

Immanent Critique

In this way, I found myself at a point where the research objective of this thesis and how it was to be constructed could not be distinguished from each other in terms of the diversity of artworks in question, multiplicity of dimensions encountered, and multi-layered problems that cross them. The best word I could find to explain my relationship with the artworks studied in this thesis was “immanent critique”⁷. An immanent critique is neither a critique from a distance, which generally purports a value judgment to a criticized field, nor a discovery of a hidden potential, once found and then applied to all situations⁸. It orients itself alongside a trajectory of the

⁷ For an example of an original transdisciplinary account that “mobilizes” an immanent critique, see, Manning, E. (2016). *The minor gesture*. Duke University Press.

⁸ In the first pole, we see critiques of Jeremy Rifkin and Carol Gigliotti. Rifkin accuses the biological arts of legitimizing very negative and disruptive effects of neoliberal capitalism (Rifkin, 2013). As for Gigliotti, who presents a more refined critique, she develops her arguments through animal studies and rights by applying them to molecular scales (Gigliotti, 2009). In the other pole, we find almost all the literature on biological arts. The problem on this side is that once this literature determines a certain potentiality in the functioning of these artistic forms, then abstracts it from the ongoing and modulating forces of existing formations. See, for example, Kac (2007), Mitchell (2010), Da Costa & Philip (2010). The account in this

production of these practices without reference to anything outside of it⁹. Immanent critique demands, in a certain manner, the suspension of moral assumptions, pregiven discursive formations, or already designated criteria of methodologies. It grasps the criteria of evaluation with respect to the artworks mentioned in this thesis in their self-relation to the elements that compose their dimensions.

When I say dimension, I firstly mean relationship with the sciences. As disciplines of knowledge, they make a claim to objectivity. The sciences present themselves in objective laws, chemical, physical, or biological processes and causes, and material forces as self-evident entities generated by scientific activity. As they do, they look upon the world at reflective remove, redundantly adding supplementary dimensions to it. Scientific statements produced in direct relation to scientific activity are undoubtedly related to these dimensions. However, as they bring a larger social plane to which they resonate, they exhibit a power in the direction of exceeding them. Something is “happening” between the sciences and world; this happening involves a multiplicity of meanings, orientations, and modes of existence, within which they are implied and, in turn, imply their own formative techniques (protocols, discourses, methodologies, etc.). This resonance¹⁰, mutual influence between the world and the sciences creates the formative potential that, in a way, enables the advancement of sciences. Potential enters the co-occurring dimensions of the sciences and perishes as soon as it is relayed to existing mechanisms. But its perishing also marks a rebirth. Following this mark, an artistic expression forms a dynamic unity that will yield

project is most closely related to the perspectives developed by Eugene Thacker (2005) and Thierry Bardini (2011), who focus their attention on the specific conditions of possibility of such practices.

⁹ For example, see Deleuze’s account on Nietzsche (Deleuze 2006, p. 91) or Kant (Deleuze 1984, p. 3).

¹⁰ There is a certain interest of social sciences and philosophy towards terms such as resonance, inference, or echo, often borrowed from physics. However, in order for the use of these terms not to remain simply at metaphorical level and become a real conceptual force, it is important to make the necessary elaborations in terms of the problems under consideration. This project in a way gives itself such a task. For a philosophical use of the term resonance, see Sloterdijk, P. (2011). *Bubbles: Spheres Volume I: Microspherology*. Semiotext (e). An example from the field of social sciences is Hartmut Rosa’s interesting work, who thinks of resonance in contrast to acceleration, see Rosa, H. (2019). *Resonance: A sociology of our relationship to the world*. John Wiley & Sons. Although Rosa’s work is directly situated in the field of sociology, it is similar to this project in that it finally makes an ethical proposition. Unfortunately, I could not benefit from this book throughout the writing of the thesis (I thank Melike Sahinol for bringing this book to my attention).

an extra-effect resulting from the coming together of the co-occurring dimensions of the sciences. What the outcome is exactly is an open-ended question that should be constructed in a network of questions that make a problematic field. An immanent critique draws a question mark. In this thesis, the question mark was given a specific expression in every chapter. But before that one last parenthesis. *Encore un effort pour finir l'introduction.*

In attempting immanent critique, there is the danger that the constitution of a problematic field consisting of heterogeneous elements may not achieve a sufficient degree of consistency, as well as the resistance to suspending judgments themselves. In this respect, I need to acknowledge the role played by my supervisor, Thierry Bardini, in terms of this problematic character as part of the methodology debate. Bardini fulfilled a dual function throughout this research. Being aware of the reproduction mechanisms of judgement, he encouraged a somewhat experimental approach. But at the same time, whenever the contours of a problematic field could not be distinguished clearly, he did not hesitate to point out this situation (also in a kind of immanent critique style). In this respect, beyond the personal or institutional student-supervisor relations, I consider this as a contributory factor of this project (Chapter 6 will conceptualize this *resonance* as the “Bardini effect” within the context of the problem of individuation of thinking).

According to the immanent approach used in this project, the artworks produced with and through microbes invoke a problematic field for the philosophical construction that invites thinking with art and science. Deleuze and Guattari themselves define immanence a “field of experience” (1994, pp. 46–48). In this respect, the term “field” used throughout this thesis designates an experiential field that is mostly related to disciplines but cannot be reduced to them. How the sciences establish themselves, and which elements are part of the problematic field, in a way, helps to parse out the existing disciplinary landscape (see Chapter 2). But defining a field on the basis of a multiplicity of elements and their coming together assumes that there are distances between them, constituted on the envelopment of these distances. They occur across the intervals actually separating them as the constituent parts of a problematic field. However, the distance between the elements must give rise to an energizing tension that induces an extra-effect, exemplifying certain aspects of that field as the resolution of the tension. A problematic field, as understood by Gilbert Simondon and Deleuze, is not a site where problems correspond to actual solutions but an entanglement with the world populated by tendencies or potentials, which holds

heterogeneous orders together (Deleuze, 1994). In this thesis, each chapter takes one or more artworks in order to delineate the contours of a problematic field. Each one of them has its own fabric and sphere of problems as contributory factors that selectively channel the “microbial activity” occurring in different disciplinary regimes.

What I refer to as “microbial activity” in this thesis expresses a certain type of activity that cannot be reduced to the functioning of disciplinary regimes. It is the type of activity that traverses disciplinary landscape but exceeds them in different manners. This gave rise to my distinction between “being-microbe” and “microbiality”. In order to discuss how this happened within the scope of this introduction, I first need to discuss how the terms “echology” and “microbe-artwork” were born. Because the genitive (*of*) relationship between these two terms had made the question of “what can a microbe do” and its modes of being exceed the main motor of this research project proposal.

Chapters: Jumping in a Field of Uncertainties

In line with the problematic character of this thesis, the preliminary idea in my mind when I started writing the chapters was to organize each chapter around the dimensions of one or more artworks. How scientific practices, methodologies, or discourses enter into a specific work, how they are used and problematized, how the thinkers that influence the artists affect the composition of the work, what kind of factors come into play when it comes to displaying the work in an art gallery, etc. The only exception to this approach was the first chapter.

Chapter 1: From Animalcules to Microbe-Artworks

Chapter 1 includes the core of all the other chapters in potential and is where I introduce the concepts of echology and microbe-artworks. As mentioned, the use of the term microbe in this thesis has been problematic from the beginning. This is because, from the onset, it conjures up a pathogenic context (a negative image of microorganism). Today, contexts beyond pathogenicity, especially with the influence of the *Human Microbiome Project*, give a positive meaning to this term (affirmative, ecological image of microorganism). In a way, this positive meaning of the term

traverses all the artworks in this field. The exception is Elaine Whittaker's *Ambient Plagues* and *Shiver* (see Chapter 2), and partially, Tarsh Bates' *The Unsettling Eros of Contact Zones* (see Chapter 3). Therefore, it was important to follow the different meanings that the term microbe has taken in the scientific context, to make a genealogy of them, in order to draw out the lines of the historical, philosophical, or political planes in which the works in question are spread (see Chapter 2).

Following microbes' different meanings led me to the "discovery" of Antonie van Leeuwenhoek's animalcules, where the term microbe was not directly used yet, but preliminary scientific statements about the world of microorganisms were born. As I researched the story of the term, I found almost enough material to write a doctoral dissertation (a situation I encountered frequently throughout different contexts of this study)¹¹. The decision to start the journey of the artworks related to microbes from the point of the discovery of animalcules took me to a thought experiment and has yielded the essential proposition of this thesis: an echology of microbe-

¹¹ In the doctoral forum organized within the scope of the joint PhD program in Communication Studies of *Université de Montréal*, *Université de Québec à Montréal*, and the University of Concordia, whose aim was to give feedback to PhD students by two professors and their colleagues about their PhD projects, it was the critique I received most from the professors: "you don't want to write one thesis, but at least three!" They were probably right in their criticism. From the very beginning, the desire to make a project about the relationship between the sciences and arts implicated clear but obscure ideas (I borrow this expression from Leibniz): examining the science-art interaction as a composition of an irreducible multiplicity of dimensions. So, for me, every presentation I made in the doctoral forum was in a way a description of aspects that were sufficiently distinct from each other, but somehow related. Once I even applied French agronomist André-Georges Haudricourt's concept of "direct action" to turn it into a unique method. Just like in Chinese intensive agriculture the material to be dealt with is not brought together according to a pre-determined set of criteria, targeting a specific region of the field, but various operations are applied on various elements in the environment. The target area is only approximately determined in the beginning and is aimed to grow on its own. The only criterion is not to fall into an infinite regression and to produce an outcome at the end. The evaluation of this thesis will, in a way, look at how well an echology of microbe-artworks fulfills this criterion. On the other hand, I have encountered the danger that the professors may have pointed to several times throughout the writing of this thesis: while pursuing a curiosity, moving away from the original dimensions of the thesis. While writing Chapter 4, there was the danger of getting lost in an interesting 9th century debate on iconoclasm I encountered in Marie-José Mondzain's image analysis (see, *Discours contre les iconoclastes / Nicéphore*, Klincksieck, coll. « Klincksieck esthétique », no 52, 1989, translation and presentation by Marie-José Mondzain; see also Mondzain, M. J. (1996). *Image, Icône, Economie*, Imaginaire Contemporain, Paris: Seuil). In Chapter 5, I suddenly found myself researching a German biology school, whose history dates back to the 19th century that suggests understanding life through rhythmical biological processes (see Guattari, F. (2011). "La sémiotique du brin d'herbe", in *Lignes de fuite*, L'aube Poche; see also Wellmann, J. (2017). *The form of becoming: embryology and the epistemology of rhythm*, 1760–1830. Princeton University Press (I thank Günes-Helen İştan for recommending this book to me).

artworks. Leeuwenhoek's animalcules offered a way for me to study the very *thing* I started to research through artworks related to microbes, using contemporary scientific possibilities, but did not know what it was yet. Leeuwenhoek's research process emerged as a result of marvel before the world of tiny creatures. He couldn't exactly link them to the full-fledged scientific term, yet his process of exploration opened a small gap in the history of the sciences that would close with scientific progress.

By looking at the story of animalcules, I noticed a similarity between certain expression of microbes in different scientific contexts emerging with an effect of unexpectedness and the interval opened by animalcules. Moreover, this interval caused other events to intervene until it reached and closed at fully consistent scientific statements. For example, philosophical events. Indeed, a lot of philosophers were impressed by Leeuwenhoek's discovery, and began to reflect on them in terms of their own philosophical questions. Here, two philosophers especially came to my attention: Gottfried Wilhelm von Leibniz and Baruch Spinoza¹². They both shared Leeuwenhoek's marvel in their own philosophical way, within their own philosophical agenda, but in a way irreducible to givens of their philosophical system, making microbes a philosophical question. The scientific gap reverberated in the philosophical gap. For Leibniz, it was about the conditions of possibility of knowledge. When exactly did something acquire the status of knowledge? What was the relationship between scientific activity based on observation and the use of mathematical devices and technical tools, and the constitution of the world on which it is grounded? Although Leibniz took into account the conditions of the formation of scientific knowledge, he essentially posed it as a problem of the production of new knowledge.

How is it that we can generate a new knowledge based on what we know before? The theme of perception, one of Leibniz's previous fields of philosophical research, occupies an important place here. If our perceptions were to give the perception of the thing perceived all at once, then there would be no need and space for new perceptions. So, there must be such an aspect to what we perceive that it allows our perception to also comprehend an imperceptible side: tiny

¹² Philosophers of the same period such as George Berkeley, Nicolas Malebranche, and Blaise Pascal also addressed the discovery of microbes in their writing. The reason I did not include them in my thought experiment is that I thought at one point that they did not establish a sufficiently adventurous relationship with microbes, but rather used the discovery to verify their own philosophical systems. In any case, I think many interesting lines can still be drawn from all these philosophers' relationship with microbes.

perceptions. Existing perceptions can give way to new knowledge only thanks to the presence of these tiny perceptions. Meanwhile, from the point of view of the anchoring of our current perception in the world, there must also be a movement that captures the tiny perceptions so that the transition from the known to the unknown, from the imperceptible to the perceived can be achieved. This, according to Leibniz, is due to our “concernful” preoccupations. In other words, some aspects of what we perceive appears as a question. Only within the driving force of a problem could the tiny perceptions be rendered perceptible. So, what happens to the tiny perceptions before we catch them? They must continue to exist and influence us in various ways. Given that we constantly perceive other things, they must also be changing, entering into interrelationships with each other, and structuring our ordinary perceptions.

At this point, something strange happened. While working on all these matters, I happened to be reading Deleuze’s book *Pli* on Leibniz (1988) and came across an interesting term: echology. It appeared in a footnote, in the context of Samuel Beckett’s *Malone Dies* (1951), and refers to a study about French sociologist Gabriel Tarde. Deleuze says that this term, which concerns the processes of possessing and releasing tiny perceptions, could become an interesting concept if developed. I found the book that Deleuze was referring to, Jean Milet’ doctoral dissertation published as a book (1969). Interestingly, the term once again appeared in a footnote and again remained undeveloped. Echology is based on Tarde’s suggestion that ontology, as the study of being, be replaced with the study of possessions, as the different modes of engagement with the world. In the sense of Tarde, “possession” refers to something close to Leibniz’s interplay of tiny perceptions, to a field of relationships, which appear and disappear, determine our feelings, thoughts, representations, and meanings, but cannot be reduced to them¹³. Tarde doesn’t refer to this process in terms of tiny perceptions, but of the flows of desire and belief. For desire and belief express the directions of our unconscious acts, the social thinking-doings to which they are channeled. Thus, the best way to think about the flows of desire and belief is to consider them as tendencies, not representations. There are two fundamental tendencies for Tarde: critical tendency

¹³ For a similar project of thinking the being as the complexity of different modes of existence with the term “possession” through different philosophers, see Debaise, D. (2011). *Philosophie des possessions*. Dijon: Les Presses du réel. David Lapoujade uses the same concept in her short but dense book about Étienne Souriau, see Lapoujade, D. (2017). *Les existences moindres*. Minuit.

and creative tendency. In the first, the novelty of the actions guided by the flows of desire and belief in terms of existing social formations remains within given parameters, while the second leads to new acts and doings to be addressed under the name of “invention”. Here, echology refers to the study of modes of relationship that traverse the visible, settled formations of the world, but cannot be reduced to them and sweep them altogether. Neither in Deleuze nor in the work of Millet who originated the term were the possibilities that echology could bring examined and so the suggestion of echology remained only a curious footnote.

The proposal of echology seemed very meaningful to me in terms of my initial intuition to examine artworks produced in relation to microbes. My impulse to study the tension between the expression of the unexpected side of microbes in sciences, and the attempt of settled formations to contain it and their relative failure, had now found its expression: an echo. Moreover, considering the term *animalcule*'s overspilling effects on Leibniz and Tarde, the echological proposition is not abstract. On the contrary, the uncertainty arising from the incompleteness of the term led to a productive process under the form of philosophical questions and channels opened by the elaboration of these questions poured into the basins of new problems and research programs. Likewise, an echo is never just about itself. As a sonic phenomenon, it is born in the gap between at least two objects, and due to the interaction between them, it is terminated, elongated, or shortened, interferes with other echoes, enters various relationships with them, and induces the birth of other echoes. Hitting and bifurcation, proliferation and inhibition, and sustaining and stopping. The way to understand how all of this takes place is to look at in which environments and under what conditions echoes occur. Furthermore, this process, without assuming a privileged point of view, is based on dealing with problems encountered en route. And, who knows, in the wake of a happy coincidence like the one of finding the term echology, it may open the door to the creation of new problems.

Following the trajectory that *animalcules* put me on, the research now incorporated the echo of “echology” itself much in the same way the term progresses: in snowballing fashion. The gap opened by *animalcules* made possible bifurcations in philosophical thinking. At this point, Spinoza injects his own questions into the process: the problems of rhythm and ethics. When two or more entities (individuals) enter into combination, the relevant parts for each resonate together as to inhibit or strengthen their relationships. According to Spinoza, this relationship itself

constitutes the basis of ethics and the dimensions of ethics as the performance of forces unfold depending on the variations in the situations. The next stop in animalcules' journey is not as straightforward as the relationship with philosophy but develops from the relationship established through the most essential tool that produced it, which is the microscope. Research in the optical field that made possible the invention of the microscope resonates, this time, in the paintings of Johannes Vermeer. There are two interrelated problems here. The first is the problem of interpretation of a work of art, and the second, the ungraspability of artwork. How is this ungraspability to be addressed without, from the beginning, tying an interpretation of the work's dimensions to a regime of understanding? Here, Georges Didi-Huberman offers an angle of entry. Instead of a hermeneutic that adapts the meanings produced by representative systems to the conditions of an artwork, Huberman defines art precisely as what displaces these systems.

Thus, the path of animalcules, which I entered on the way to researching artworks produced in relation to microbes, offered all the conceptual and methodological frameworks I was looking for. Throughout the thesis, I consider these artworks in relationship with microbes as "microbe-artworks". Here the hyphen refers to the problematic relationship between microbes and artworks as an emphasis of the problematic character of echology. Therefore, the main promise of this thesis was also concretized: making an echology of microbe-artworks in accordance with the specific problems of each chapter. The works I discuss, the questions I ask, the concepts I use all appear in line with the requirements of each chapter. Already in Chapter 1, however, we saw some themes arise through the adventure of animalcules. With Leibniz, the theme of epistemological questions and tiny perceptions that traverse even the most consistent forms of knowledge. With Spinoza, the theme of rhythms and ethics. And finally, together with Vermeer, the problem of thinking and analyzing a work of art and of following its escape from existing formations. Each chapter thus focuses on one or more microbe-artworks and identifies the problems in their relationship with microbes.

Chapter 2: A Microbe-Aesthetics

Chapter 2 explores how microbes become the subject of aesthetics through Elaine Whittaker's artworks, *Ambient Plagues* and *Shiver*. The transformation of animalcules from a footnote in the history of science into their full-fledged scientific notion as "microbes" and its different ways of

entering and affecting various social environments prepare the conditions for a microbe-aesthetics. The scientific categorization of microbe placed the meaning of “disease-causing” entities in the semantic structure of the microbe, and for a long time, dominated the contexts in which the microbe was addressed. Georges Canguilhem, however, demonstrated that even when microbes are embedded in the context of disease-inducing entities, scientific research has to assume and take into account aspects that exceed it.

The term *milieu*, which has been conceptualized since the 19th century, drives microbes from the interplay between normal and pathological according to the way diseases are defined to other “adventures”. The context of disease marks the situation, from this perspective, where microbes escape from control. The birth of the clinic is about generating global responses to these situations. In *La Naissance de la clinique* (1963), Michel Foucault examines the transformation of the clinic and discusses the reciprocal modes of implication of control and escape. In Foucault’s reading, Xavier Bichat’s concept of tissue brings together the interplay of life and death onto the problematic surface of diseases’ eventful dimensions. Thus, the increasingly scrutinized gaze of the clinic, with the increasing coordination of different scientific disciplines and, ultimately, integration of different units of the State, makes the clinic, hence diseases, and hence microbes, a matter of power formations. I read Foucault’s analysis of epidemics in *Surveiller et Punir* (1975) to demonstrate the uncontrollable side of microbes and the effects that further refine the techniques of power relations. On the other hand, it is exactly this reading that brings up the aesthetic problem regarding microbes, with respect to the problem of thinking from (of) outside in conjunction with Foucault’s relationship with Maurice Blanchot. The place where aesthetic value is established in Kantian philosophy is the place where human faculties break down and a fascination with nature comes to light. The question of “what can something do” makes sense only at this point, according to Deleuze’s reading of Kant, revealing the spatiotemporal dynamisms that cannot be reduced to representations in the already known spatiotemporal coordinates. After this moment, the concordance of other faculties in a general discordant structure become possible in the aesthetic judgment. In a way, here, the beauty of microbes also comes to the fore, only after this uncontrollability arising from their destructivity is partially, relatively controlled.

Thus, in *Ambient Plagues*, I show how Whittaker draws attention to the parallelism between the representation of microbes in popular culture as destructive creatures and a certain

contemporary image of microbe that reflect the beauty in the nature and the “uncomfortable dialectic” between them. Whittaker places horrific images of human faces, taken from dystopian films where microbes cause disaster, in a petri dish. In this chapter, I show how this description and symbolism problematize the possibility of a microbe-aesthetics. Meanwhile, using *Shiver* as an example, I show how the idea of destruction with which the biopolitical context of epidemics is associated provides the possibility of contemplating microbes as beautiful entities.

Chapter 3: Microbe-Ecologies

In Chapter 3, this idea of destruction associated with microbes disappears and leaves its place for affective situations such as irritation and discomfort, care and love. In this chapter I use Tarsh Bates’s *The Unsettling Eros of Contact Zones* to illustrate how the work functions to show that the living world of *Candida albicans*, which is described as thrush in the human world, is irreducible to the negative experiences of human beings. In *Eros*, the transformation of classical immunological discourses, which conceive of human beings as a fortress to be defended, towards ecological approaches focusing on different modes of interrelations between living beings is reflected in the determination of different *Candida* characteristics such as its shape shifting abilities, capacity to act both in commensal and pathogenic ways, or strategies of undetectability. Bread leavened with *Candida* turns the art gallery into an original research site by bringing into the fore feelings about the thrush context and the different capabilities of this microorganism. Here, I also examine the contribution of Donna Haraway in the composition of *Eros*, who appears as an influential figure in the academic articles of Bates. Haraway’s concepts such as “contact zones”, “companion species”, and her remarks on the transformation of immunological discourses are discussed in terms of their contribution to the project. Likewise, in this chapter, the interview I conducted with Bates, from a similar point of view, constitutes another “echo” as a participatory element that expresses the interaction between the work and its examination in analysis. Immunological and ecological discourses, Bates’ biological laboratory practices, the concepts mobilized in her work, our interview, artistic methodologies, and arrangements in the art gallery all finally yield an ethical-aesthetical proposition as the outcome of Bates’ “processual art”, which is based on care and love.

Chapter 4: Microbe-Images

Here, I address a problem that is actually already implicit in the first chapter's study of animalcules, this time through microbe-artworks: the privileged place of sight and seeing in the construction of scientific knowledge. In a way, the construction of scientific knowledge occurs with the creation of a fully illuminated region of reality by bringing together obtained dispersed data within the scope of the schemes at hand. Thus, while a category shows what it shows, its explicitness brings with it a number of dimensions that are not directly shown, but which condition the representation, and which themselves are made up of various bundles of relations. Imaging devices, which are used in scientific activity, do not only fulfill a function of clarification, but also enable a "reading", an "image" about the world, life, and nature. In this chapter, I propose that microbe-images problematize a movement from the invisible to the visible, which is nested in the being-microbe.

Thus, the real question is, with what tools and how is a microbe-image generated? In this chapter, I use the image analysis of Marie-José Mondzain, who grasps the image as a relational field where invisible dimensions are rendered connected with each other by various operations. Mondzain captures a philosophical moment in the relationship between icon and image through the discussion of iconoclasm and asserts that it is also essential for the discussion of contemporary images. It is the image economy that provides the transition from the givenness of the icon to the relational infinity of an image, operationalized by the ecclesiastic apparatus (*dispositif*) in the case of iconoclasm. When microbes are in question, ecosystemic complexity, which becomes the focal point of ecological approaches, is translated into various images through technoscientific operations. I then show how Günes-Helen Isitan's *Hybridities: Almost Other* reveals some of the invisible aspects of the microbial field through the problem of hybridity. In *Hybridities*, photographic possibilities and appropriation of scientific discourses and practices are operationalized towards the production of microbe-images as the problematic coming-together of human faciality and microbial interactions. I then use François-Joseph Lapointe's *Microbiome Selfies* and *1000 Handshakes* as an example to show how an image economy is established by means of metagenomics and bioinformatics. Each social act such as handshaking, kissing, or eating creates a field of interactions with microbes, which produces a small change in the current structure of the body. In Lapointe's work, this is the change made visible by means of metagenomics and

bioinformatics. The resulting color aggregates and more or less distinguishable geometric shapes are the figurations anchored in microbial complexity waiting to be read. I then propose this as the ethical call of the microbe-image, again with reference Mondzain, and echological writing as an attempt to respond to this call.

Chapter 5: Microbe-Sounds

The possession of an echo can only occur in the activity of listening. In this experience, some elements participate more distinctly, others more vaguely. A field of rhythms is made up of weakening or prolongation, diminishment or amplification. Listening, or being involved in a certain activity, or even having a certain interest, is also participation in this field. The examples of microbe-sounds offered in this chapter constitute the different modes of microbial rhythms. The genealogy of certain scientific discourses that suggest considering microbial properties as rhythmic blocks and contemporary biological practices and technical tools that enable the production of microbial sounds intermingle in different rhythms in various ways. This happens through the transformation of various electrical, physico-chemical, and biological processes and energies into more or less meaningful sounds that can be distinguished by the human ear.

To grasp this transformation without reducing the different levels to each other, I appeal to Simondon's concept of transduction. The *Refrain* chapter in Deleuze and Guattari's *A Thousand Plateaus* conceives the outcome of transductions through rhythmic patterns (1987). In the case of *Interspecific*, the microbe-sounds are the result of the capture and production of various regimes of non-human rhythms based on the physicochemical properties of microbes. In *the dark side of the cell* project, I show how the problem is that the vibrations between different cellular processes are transduced into sound production to fulfill a scientific function through the technical tool of sonoctology. Here, the concept of "milieu", again from Simondon's philosophy, helped to pose the problem of rhythmicity involved in the interactions between cellular milieux, exterior, interior, intermediary, and associated milieux, as a problem of echoic transitivity. Finally, I show how two art projects, Günes-Helen Isitan's *Microbiota's Song: The Poetry of a Tongue* and Victoria Shennan's *Anthropocene*, operate to make audible a refrain that traverses the being-microbe, a refrain of a dissonant, yet harmonious relational being. In Isitan's work, the effects of microbes on photographic film are generated into a soundscape, while in Shennan's *Anthropocene*, DNA and

RNA codes are converted into sound through algorithmic codes. Microbe-sounds consolidate in an artwork a refrain captured by sciences, making the echoes re-echo in other turns. Here, I propose ecology as the research of this seriation.

Chapter 6: Microbe-Milieu

In this chapter, as well as in Chapter 7, I bring into fore the two fundamental issues of the project that cross all the chapters: milieu and ethics. The concept of “milieu” encompasses a complex set of relationships that vary according to the environments in which the characteristics of life that are determined in the laboratory environment, the structure of the clinic, and the States’ capacity of mobilizing institutions to capture potential come together (Chapter 2). The emergence of ecological approaches, in some ways, has gathered the unlimited diversity and complexity of the living environment and summarized them in a variety of observable features in the form of a relational economy of movement (Chapter 4). In the case of a microbe-artwork, the different elements, scientific discourses, practices and protocols related to microbes, art gallery arrangements, a certain conceptuality that concerns the selection, and the assembly of components all contribute to the production process (Chapter 3). Chapter 6 examines how the experiential qualities of microbes become the subject of an artwork in an apparatus or installation. Saša Spačal’s *Mycophone_unison* is used as an example which summarizes the microbial complexity in sound generated through a plate activated by human touch. I show how, in the work, the symbiotic relationships that microbes enter with the environment and humans are symbolized by the feedback and forward mechanism of this central celestial plate.

In this chapter, I also attempt to address the problem of expressing symbiotic modes of relationship in thought, which the sciences have put forward. For this, I refer to Simondon’s example of the symbiotic relationship between crab and anemone (2013, pp. 195-200). Another work of Spačal’s, *Economy of Symbiosis* creates a small ecosystem consisting of a plant of red clover, a bacteria of rhizobia species, water, light and sound, by bringing together the relations between disparate elements in a working system. It provides an example for thinking of symbiosis in a framework not limited by the scientific points of view. In this chapter, I pose it as a problem of the individuation of thinking.

Another example in this chapter is the work of Sonja Bäumel. With reference to complicated microbial communication methods such as quorum sensing, Bäumel poses the question of how the microbial relationship can be experienced without being limited by an instrumental context. In *Crochet Membrane*, *Fifty Percent Human*, and *Being Encounter*, she seeks to translate the microbial processes that oscillate between visceral and sensible to human senses. I also use this as an occasion to consider the implication of the sensory modes involved in the biological in thinking itself. There is a side in thought that cannot be reduced to the senses, but that surpasses them. On the other hand, shouldn't elemental particles, located at different levels and layers and which concern the expression of the biological processes in the wider, complex social, economic, and political processes, also be expressed in thinking? Do not some of the features or sensibilities revealed by the resonance of a microbe-artwork with the sciences, and the biomedical and biopolitical processes in which they are included, extend themselves to a reflective attitude?

To answer the above questions, I return to Simondon's example of the crab and anemone relationship in order to expand it towards the relations between science, art, and philosophy. On the other hand, I also use this as an opportunity to problematize ecology's own individuation, which proposes to consider the relations between science and art according to a logic of resonances and interferences. Through Bäumel's work, I consider the possibility of expressing the microbial qualities experienced in a milieu through sensory modes in thinking, this time, in a completely different context—Thierry Bardini's book *Junkware*. In Bardini's account, thinking of the complexity of the biological and its entanglement with other fields cannot be separated from the problem of writing style. Rhythmic movements of the empirical and abstract, in their indistinguishability, offer an example for ecological thinking-writing practice. In this chapter, workshops are also considered as another milieu where this practice resonates. I conclude the chapter by following a Simondonian line of thought and suggesting that vital individuation and the individuation of thinking also involve an ecological relationship throughout a process of resonances and inferences.

Chapter 7: The Promise of Microbes

Microbe-artworks are situated as an interface that opens various types of problems through this process. As I have attempted to demonstrate throughout this thesis, the in-between is itself problematic and in no way can be exhausted by structural subordination. This is another way of saying that the finality of microbe-artworks is ethics. In the last chapter, I define ethics as the ability to possess a divergent complexes of forces and perform affordances and capacities, unlike morality that derives the evaluation method from pre-determined criteria. Thinking of the echoes of microbial relationship modes with science and art is itself an ethical act as the participation in their resonating problematic fields. To develop these points using various microbe-artworks as examples, in this chapter, I benefit from Brian Massumi's project to revitalize the concept of value. Massumi aims to develop an understanding of ethics through the concept of value, which is based on the activities' performing their capacities in various modes. Each emerging value emphasizes that the richness of life cannot be contained by existing forms, structures, and meanings. Each value is a surplus-value of life. This carries the problem of ethics fundamentally to the heart of neoliberal capitalism. Contemporary capitalism has made itself sensitive to capturing value as it emerges and channeling it into profit-making mechanisms. But still, the surplus-value of life and the capitalist surplus-value are not the same, and there is a conversion of the first to the second. This also comes to say that that every situation has an ethical side, and one echoed in the capitalist problem.

In the last chapter, I look at how the works of Raphael Kim and Kathy High perform this situation. In both their projects, microbes are conceived as beings that are worthy of storing, exchanging, and being able to self-proliferate their own value. That value, however, has to be created out of certain microbial properties themselves. Kim's *Microbial Money* and *Peck As You Go*, and High's *You Are My Future* emphasize the promissory aspects of microbes. Kim produces a microbial value by means of laboratory practices and develops speculative scenarios in conjunction with the institutional landscape for the storage and circulation of value (again, in another parenthesis, Kim's microbial currency's meeting with Pierre Klossowski's *Living Currency* awaits us in this chapter). Meanwhile, High's project *You Are My Future* includes different artworks. Rather than classifying them in historical order, in this chapter, I bring them together under the "paradox of abject". Interestingly, here, the context of disease comes back, but this time with an affirmative twist. The social, economic or political value generated by the engagements with microbes in different milieux contains the possibility of a post-capitalist society.

The composition of values that emerges here finally coincides with the problem of death. The last two microbe-artworks I examine in this thesis, High's *Burial Garden* and *Nos Habebit Humus: The Earth Will Have Us* allow us to place this death-microbes relationship in an ethical perspective (thus, closing a parenthesis opened in the second chapter with a kind of life and death paradox).

* * *

The problematic character of the relationship between the sciences and arts, which constitutes the core of the ecological proposition, lies in this perspective. In the structure of the problematic, there is affinity between the death coming from outside and thinking's becoming possible only by thinking the unthinkable. It reveals the vocation of the present project, an ecological thinking-writing proposal: participating in the problematic fields as an ethical act.

0. Actuality and Us

Il n'y a pas d'élaboration sans recherche, pas de recherche sans tâtonnement.

Bergson

There are two basic meanings of actuality: the state of being actual, and that which is related to actual conditions or facts. Certainly, the two meanings are interrelated. The first basically refers to the present state of things, their here and now manifestation in acts. The other is about the conformity of actions; the undeniable existence of reality and its necessary outcomes; facts, truths, or objective conditions. For example, a day consists of certain activities: going to work, doing such or such things, or organizing the day around already planned activities. We have our repertory of realizable things. We can repeat them in certain ways, or add new ones to them, even though, in time, we acquire a certain feeling for our abilities (I can imagine a world in which I play snooker like Ronnie O'Sullivan, for example, but it is not this world that this will happen in). The more we do the same activities, the more we get used to them, and accordingly, actualize them in certain manners. Even so, when we begin new activities, we reorganize our abilities, and adapt them to new actualities to the extent permitted by our capacities. In this way, two things happen. In the first case, what is put into action becomes part of an agenda; one expects how the actuals will follow. A habit or routine forms and maintains enough energy to repeat itself in the next turn, iterating the same procedures with slight variations. In the second, existing actualities interact with new ones, and, as a result, expand in ever larger circles. My affairs, my neighborhood's affairs, my city's, my country's, the world's . . . all somehow become interconnected. For what is actual is that which is not when it passes another actual. For an actuality to actually be actual, to keep its form as such, it must possess a power of acting, a marge of inactual, running through the transitions from one form to another. Actual actuality is pulled out from two sides. Firstly, by the abrupt ingression of surprise; a factor of chance, altering the actuality, accompanied by its power of becoming otherwise. Now, already more or less known paths of experience appear as unexpected. Secondly, it is pulled out by the interruption of its ordinary stream in the encounter with a problem,

not in the sense of obstacle, but as a projection towards its inactualities so as to meet with other actualities. A problem is a new path-giving factor for actual actualities. This second aspect of how actuality is pulled towards its otherness is not deprived of chance factors. Rather, its character is primarily determined by a weariless effort of trying to open new paths, already foreshadowed in actual ones, but immediately covered up by actuality's expected next stops. Stops, now prospected in actuality's transitions as if heralded by an inexistent future. A new path is not guaranteed. There is a high risk of getting lost in back streets, streets that either open into a dead end, or turn into a labyrinth without an exit, or end up being the more or less already known actual paths. The second option would be tolerable, if the attraction to a future that strives to make room in the present wasn't so insistent under the problematic form, joyously pushing for existence, irresistibly and in fact intolerably provoking demonic alliances. Like a tenuous sound persistently coming into the ear; as if about to spill into the mouth to become a melody, it vanishes before it can be expressed. You can only hum along, rehearse it again and again, without ever being sure if it will even turn out to be a melody at all. Still, among the countless murmurs hitting the eardrum, the tenacity of the ones that make it feel like such a melody, even in their quasi-existence, make all calculation of probabilities meaningless. Even when the sound fails to hold onto the ear, it at least instructs us for tried and mistaken paths, gives us an affinity with inactual actuals, and maybe plants seeds for other inexistent futures. Because these futures have already been lived.

Chapter 1:

From Animalcules to Microbe-Artworks: Echoing Science, Philosophy, And Art

Imagine a room with neither doors nor windows. A room in almost absolute darkness. But, the eyes slowly get accustomed to the darkness. They begin to distinguish certain objects, feeling their presence in the room. There isn't a crack somewhere infiltrating light into the room. The objects themselves carry particles of light that, when in the vicinity of other objects, recapture them as if intending to reflect the light in each other. This is how a certain area of the room gets a small portion of visibility. The more the eyes penetrate the barely visible areas, the more they acquaint with the reflections of light particles. The eyes learn how to pass from a bright area to darker sides. Now, some areas of the room are visible, some are in absolute darkness, and others in the infinite nuances in-between. The philosophy of Gottfried Wilhelm Leibniz is devoted to enlarging the brighter areas of the world by the dint of various fields from physics, optics, and mathematics to biology and even politics. But the possibility of new knowledge's coming into light is always a matter of ebb and flow between the flicker of obscure zones of reality, sinking into a dark, unattainable background and the infinite solicitations of tiny perceptions, coloring the world in unpredictable ways.

Another scenario. This time, a room which is immersed in light. All the curtains and doors are fully open. Light embraces everything. Yet, this fact doesn't contradict the actuality that the room is still full of nuances between bright and shadowy areas. The power of the light is surveyed on the objects, and conversely, the power of the objects travels across the light reflections. An object's receptivity to light never remains the same; it varies according to an object's texture, the time of day, or the other objects in the room. The increases and decreases in the capacity of reflectivity reveal the manners in which an object will reflect light in solidarity with others. From the perspective of another philosopher and contemporary of Leibniz, Baruch Spinoza, darkness appears simply as an effect of light, and is a matter of illuminating the world by various ways of absorption and reflection of light with respect to the interactions between objects, their capacity of being affected by light, and of affecting it. Objects will construct clusters that will alter light

reflections as to produce infinite color variations. Light as a problem of capacitation and interaction.

Now, we are in more or less the same type of room, one receiving light from all sides. Infinite color variations are distributed around the room, changing with the time of day and variety of objects, human beings, or gestures. Each time a unique composition of the room appears as if to give way to another one. Some of the compositions remain more intriguing than others, and it is the painter that will recompose them according to his priorities for selection. Johannes Vermeer paints those instances of suspension, letting the light so as to display the interplay of light on the poses, postures, gestures, and the environment in which the light is distributed, or condensing the light on a particular object, accentuating its contours. Vermeer wishes to leave the stage to light itself, and creating multiple perspectives in the manner of a nonjudgmental observer. In the end, he uses his optical devices as experimental means for creating a desired effect in the space of painting.

Multiplying itself, it seems, is the natural inclination of light. To cope with the immensity of its variations, one must have some techniques of limitation with regards to one's preoccupations, for staging light in thinking or perception. Leibniz looked among various fields to compose his materials of reflection. Spinoza was a lens grinder by profession, aware of the necessity of polishing lenses for observing the unceasing perseverance of things, and their capacities under different light conditions. Vermeer experimented with different devices that would allow him to capture the instantaneous apparition of things in space and time. Finally, Antonie van Leeuwenhoek used light to increase the magnifying power of lenses. With an intuition and curiosity that there must be more to the visible world, Leeuwenhoek examined all sorts of things under his microscope. One day he was amazed by the barely visible movement in the water he was observing. Since antiquity, motility was a sign of vitality, and those tiny creatures had to be the small versions of animals. Now, light paved the way, not for philosophical investigation or artistic enterprise, but for the discovery of a hidden realm that would later become a specific object of the study of life sciences. The existence of animalcules, as Leeuwenhoek named them, was repeatedly verified by other people, to be finally once and for all authenticated as microbes by the scientific

community¹⁴.

* * *

How to think of these four scenarios together, this time through the discovery of “animalcules”¹⁵?

The Beginning of the Adventure of Microbes: Animalcules

This chapter is a thought experiment that aims to investigate the intersections between science, philosophy, and art through the notion of “animalcules”. The story of microbes begins in an age when the notion of microbe didn’t exist. The main argument of this chapter is that the first germs of artworks interested in microbes were sowed in the 17th century, even in the absence of microbes in the literal sense. Leeuwenhoek hadn’t only clearly observed the invisible world of microorganisms; he had also taken the first steps to scientifically explaining this world. Although, at the time, his “animalcules” didn’t have enough conceptual consistency to be validated as scientific fact, they made quite an impression in scientific and intellectual circles, drawing the attention of a lot of philosophers, including Leibniz and Spinoza. The two did not approach animalcules in order to validate their philosophical ideas but considered them as an occasion for philosophical thinking. Leeuwenhoek’s great interest in optical devices, which enabled him to make the strongest microscope of his time, and therefore, to observe animalcules, intersects with Vermeer’s use of similar devices in painting, with totally different motivations and results. In this way, we determine three directions in animalcules, which give impetus to three different fields of activity, all distinct in character. Tracing a path from animalcules, one arrow lands on scientific

¹⁴ In *Critique et Clinique* (1993), Deleuze presents a brief comparison between Leibniz, Spinoza, and Vermeer in terms of their attitudes to light. He considers that Vermeer’s paintings are closer to a conception of light and color in Spinoza, which finds its basis in his theory of conatus, defining beings through the oscillations in their capacities: “*On voit chez Vermeer l’ombre se détacher, et se porter en avant, pour encadrer ou border le fond lumineux dont elle procède (« la laitière », « le collier de perles », « la lettre d’amour »).* C’est par là que Vermeer s’oppose à la tradition du clair-obscur; et à tous ces égards reste infiniment plus proche de Vermeer que de Rembrandt” (p. 178).

¹⁵ I discovered Isabelle Stengers’s book *La guerre des sciences aurait-elle lieu?* (2001) after I finished this chapter. Stengers puts Leibniz and Newton into an imaginary dialogue. The objective nature of scientific knowledge and metaphysical postulates are put on stage through the dramatization of arguments in different scenes. Stengers calls this original style “*scientifiction*”.

characterization of microbes, another on philosophical reflections, and yet another on art practices that use certain techniques to create certain effects.

At this point, everything starts with Leeuwenhoek's amateur experiments with his microscope.

Life Squeezed into a Drop of Water

Leeuwenhoek began his career as a tradesman. His career changed direction when he was appointed surveyor for the Dutch city council who wanted to appraise his skills in creating optical devices for observing and measuring natural phenomena. Finally, with a membership to the Royal Society of England, the value of his scientific research was recognized. As a tradesman in the textile industry, Leeuwenhoek needed magnified lenses to count thread density of cloths (Crawford 2007, p. 164). He was convinced he should better learn the laws of optics to be able to grind better lenses to make powerful microscopes. For this purpose, he studied cartography, and even obtained a diploma in the field (Wadum and Blankert, 1995, p. 74). However, once he made his devices, his curiosity turned to nature, and especially, animals, which he wanted to observe. The first intriguing issue for him was the difficulty of discerning the characters of observed phenomena by natural perception and what was added to it by the mechanisms of the devices used (Snyder, 2016, p. 121). How could he be sure about the truth of what he observed? Maybe his devices, just like Descartes' evil demon, were deceiving him? There is always an aberration between the world as we know it and the world as observed under the microscope. How much of it came from the phenomenon itself, how much derived from optical illusion? Leeuwenhoek was aware of the importance of observational rigor, the necessity of detailed recordings, and the use of correct measuring devices. Yet, the first letters he sent to the Royal Society sharing his examinations on animals were mostly received with nonchalance, and even disdain (Kruif 1996, pp. 6-7). Still, he went on pursuing his research, sharpening his lenses, and magnifying the power of his microscopes. Each day, he learned more and more how to control the experimental environment, taking note of even the slightest detail. Finally, when he clearly observed the microorganisms he would later name animalcules, that is to say "tiny animals", it was not only his most fascinating encounter, but also something that would become the focal point of all his skill

development. Despite not managing to give them full scientific status, he made important progress in determining their properties, opening a new chapter in the history of sciences, and raising many interesting questions.

Animalcules are not microbes, but they point in the directions towards which microbes will later be inscribed into the history of life sciences. When von Leeuwenhoek observed these creatures for the first time thanks to the power of his microscope, ensued by the unrelenting lens grinding of his non-scientific hands, his fascination for their number, variety, and movement was only expressible through association with the world of animals. The parade of bees, horses, frogs, eels, mites, or ants only approximates the observed complexity of this new world:

For me this was among all the marvels that I have discovered in nature the most marvelous of all, and I must say that, for my part, no more pleasant sight has yet met my eye than this of so many thousands of living creatures in one small drop of water, all huddling and moving, but each creature having its own motion. (Leeuwenhoek, 1941, p. 146)

Yet, the addressees of Leeuwenhoek's letters, which begged for the recognition of his observations and discovery, were not satisfied with his descriptions. Members of the Royal Society wanted his exact methods of observation and a more detailed explanation of his findings. In response, Leeuwenhoek used every means available, from reporting experiment conditions to appealing to mathematics and micrometrical diagrams. In his book, *Philosophical Transactions* (1941), he shared his daily notes on the observation of animalcules as well as his primary inkling about the relationship between their world and the human world.

For Leeuwenhoek, conformingly to the Baconian spirit of the 17th century, observing and thinking were totally separate activities that were not to be confused: "I see, I assure, I discover... I think, I imagine, I believe". The most important thing for him was to note the diversity of animalcules in terms of their number, movement, and form: "animalcule of all shapes, spirals, elongated, round, oval, of all colors, translucent, white, green, ash gray, (some are green in the middle and white, front to back)" (Leeuwenhoek, 1941, p. 146). All these details served to make inferences about their properties, always with a little dose of hesitation to arrive at theoretical conclusions. He repeated his experiments in different contexts. He attested several times that the smallness of animalcules was not an obstacle for observing their complexity. One of the first things he noticed was their perpetual movement, which, in the end, led him to the idea of generation. To be sure, he repeated the same experiments again and again, and finally concluded that animalcules

were endowed with reproductive abilities, ones enormously put into action even in a day. Another consequence of this observation was that men also had some creatures in their testicles, ones similar to animalcules, which might assume the same reproductive function. All these observations resulted in him concluding that the world of animalcules was not a static given, but perpetually expanding, and horizontally and vertically complicated. When you looked at the water, you found animalcules; but when you approached closer and closer, you realized that there was also water in animalcules, and animalcules in animalcules, *ad infinitum*. What was the relationship among the animalcules themselves? And more importantly, did they have effects in the human body? With this insight, Leeuwenhoek didn't only observe different animals to describe their relationship with animalcules, but also tried to catch their presence in different contexts of daily life. What would be the effects on the teeth if he were to rub salt on them for years, in terms of the presence of animalcules¹⁶? What would be the case for a man who never in his life rubbed salt on his teeth, and lived in a park? In this way, he verged on discovering the effects of microorganisms on human health, even on revealing their pathological aspects. While suffering from an intestinal disorder, he found animalcules in his excrement, but didn't associate them with the reason for the distress. Leeuwenhoek confessed that sometimes he himself wasn't satisfied with his observations, especially when it came to describing the complexity of their perpetual movement and variety. But Leeuwenhoek's real passion was for his microscopes and creating the most sensitive experimental conditions; this was the main factor distinguishing him from his contemporaries. To be able to obtain the clearest vision, to see better and deeper, he mobilized all the means at his disposal.

In fact, animalcules were exactly this: neither a full-fledged scientific entity nor a mere philosophical speculation. Later, when the "animal" of animalcules would be dropped and only to have the "*cule*" conveyed to microbes, animalcules would complete their status as half-scientific fact to become just a curious anecdote in the history of sciences. But the time interval between the discovery of animalcules and classification of microbes was a point of departure through which the first elements of the production of scientific statements were determined, giving rise to heuristic approaches as well as philosophical questions. The marvel propagating from animalcules was a middle ground through which science and philosophy intersected, and exchanged elements, sometimes incorporating those elements into their field of activity or circulating them into other

¹⁶ He literally rubbed his teeth with his fingers, not brushed them.

fields. So, what were the first elements of scientization in the construction of animalcules? What were the main philosophical motivations for the reflection of this “new” world? Was there really an exchange between scientific enterprise and philosophical speculation, and if so, how did it take place in the case of animalcules?

Animalcules were like a small gap in the history of sciences, a gap to later close as science progressed. However, before the gap closed, animalcules had already given rise to some events: philosophical and maybe even artistic. Many philosophers had begun to reflect on the repercussions of the discovery of animalcules. In particular, Leibniz and Spinoza, as if sharing Leeuwenhoek’s marvel or surprise, considered animalcules as an occasion to ask philosophical questions, certainly in the scope of their philosophical systems but, at the same time, irreducible to them. The scientific gap echoed in the philosophical gap. The first point of convergence was the importance of technical tools for the observation of natural phenomena in order to obtain clear vision. For Leibniz, this was essentially a question of the structure of knowledge. What enables us to make new knowledge out of already-known things? That question would resonate in different ways in Leibniz’s thinking through the case of animalcules.

Animalcules and Leibniz

For Leibniz, Leeuwenhoek’s descriptions of animalcules based on his observations were more valuable than “the novels of Cartesians” (cited in Serres 2002, pp. 354-355). Cartesians thought they had direct access to the world by operations of the mind, and the accessibility of truth passed through the perfecting of the methods of intellect that would bestow thought with clear and distinct ideas on the objects considered¹⁷. However, according to Leibniz, clear and distinct ideas

¹⁷ For Descartes, the path opening to the discovery of the infallible truth passes from the discovery and use of “the most rigorous method”. If the world can be distorted by all kinds of illusions, meditates Descartes, then we should find the degree zero of falsifiability that will serve as a springboard for arriving at eternal truth. “Suppose [a person] had a basket full of apples”, explains Descartes to priest Bourdin by a kind of thought experiment, “and was afraid that some of the apples might be rotten, and wanted to remove them, so that they did not spread their rottenness to the others, how would he do this? Would he not first of all empty the basket altogether, and then, examining the apples one after the other, put back only those he could see were unaffected, and throw the rest away?” (Descartes, 2008, p. 220). The distinguishability of the rotten apples from good ones depends on the presupposition that number of the apples is finite and that the rotten ones unquestionably manifest themselves as rotten. Descartes’s all or none principle is only valid

are only one aspect of the picture, and a very partial one. Relying merely on intellectual operations for understanding reality bypasses the diversity and richness of sensical substance, reducing it to mental images. For Leibniz, sense data are always moved aside by the contours of clear and distinct ideas. It is not the mind that brings things into existence, but the sensations that carry the sense data into the mind, provoking their representation¹⁸. For this reason, Leeuwenhoek's animalcule observations were very valuable to Leibniz; not only did they project an image of his system, especially as a projection of his conception of infinitesimals in the living world, but they also gave insight into the conditions of possibility of knowledge. How should we look at the proximity between Leeuwenhoek and Leibniz? How does it occur that certain philosophical constructions find their expression in the testimony of the living world? Here, instead of giving a full account of the Leibnizian approach to animalcules, I will confine myself to point out some problematic knots, and to indicate some potential directions for research.

when a rotten apple is clearly distinguishable from a good one. But who can guarantee that worms are not already at work in a wonderfully looking apple and that a small parcel of rottenness will not spread to the whole basket? On the other hand, Michel Serres, by comparing Cartesian doubt with La Fontaine's parable of wolf and lamb, suggests that Descartes was aware of the critique of contamination, but the presuppositions of his philosophy didn't allow him to face the implications of this problem (2002, pp. 124-156). Just like the two argumentations of wolf and lamb enter an infinite regression since they cannot find the issue, Cartesian doubt can never penetrate into the level of bodily relations by saving itself from the minimized focal point of *cogito* established at the blind spot of the world. In the case of the parable of La Fontaine, however, the hesitation is resolved, at least, in the cutting edge of judgment: "*Maintenant, le procès est terminé*".

¹⁸ However, this critique is still too easy, and does nothing but makes Descartes a scapegoat, a well familiar trend in the postmodern age. Descartes' texts about meteorology, the functioning of consciousness, or the contemplation of infinity in mathematics present alternative readings. Deleuze and Guattari's reading of Descartes in *What is Philosophy* (1994) can also be considered in this vain. For example, for a reading of Descartes as the precursor of Freudian unconscious, see Jean Laplanche et J.-B. Pontalis (1967). *Vocabulaire de la psychanalyse. Sous la direction de Daniel Lagache*. Presses universitaires de France. Maurice Merleau-Ponty remarks that the realism of the 17th century, which he characterizes as a kind of naïve contemplation of infinity, has a prelude in Cartesian philosophy: "*le « grand rationalisme » du XVII siècle trouve le fondement commun de la connaissance de la nature et de la métaphysique dans la médiation d'un infini positif, ou infiniment infini... hérité de Descartes*". See M. Merleau-Ponty (1960). *Signes*, Paris. p. 186-187. For a creative re-elaboration of *cogito*, see Henry, Michel (2011), *Généalogie de la psychanalyse*, Paris, PUF.

Seeing and/or Thinking Animalcules

In *Le système de Leibniz et ses modèles mathématiques: étoiles, schémas, points* (2002), Michel Serres, in his intensive research on the philosophy of Leibniz, determines four points of convergence between Leibniz and Leeuwenhoek through their correspondences. In the matter of the characters of the living beings, Serres outlines the relevant aspects of Leibniz's system in four points: perpetual movement (*le mouvement perpétuel*), number (*le nombre*), infinitary interlocking (*l'emboîtement infinitaire*), and transformation or metamorphoses of the elements (*la transformation ou la métamorphose des éléments*) (p. 360). He explains that these points converge in the affinity between vision and knowledge, seeing and knowing: “*tout se passe comme si Leeuwenhoek avait vu ce que Leibniz avait pensé, et comme si ce dernier en avait eu conscience* [in italics]” (p. 355). Serres quotes a letter from Leibniz to Simon Foucher in which Leibniz talks about the importance of examining appearances more closely, and better approaching the links between the reality of phenomena:

Les microscopes nous font voir dans le moindre atome un monde nouveau de créatures innumérables, qui servent surtout à connaître la structure des corps dont nous avons besoin. (pp. 374-75)

What Leeuwenhoek saw and what Leibniz thought reverberate in each other, interestingly, something Leibniz was aware of. Where did this awareness come from? It evidently arose from Leibniz's approach to epistemology. The faculty of seeing serves as a natural model for the basis of knowledge. But what is the basis of this *natural* inclination between vision and knowledge? Which characteristics of vision make possible the production of knowledge?

Unlike Descartes's clear and distinct ideas as the ultimate destination of human experience, Leibniz finds experience always in muddled situations. When we experience something, only a small portion of what we experience gets visibility in our consciousness. Colors and things share the same type of genesis (Serres, 2002, pp. 112-117). There is an affinity between the classification of ideas and the theory of color, knowing and seeing, knowledge and vision. Examination of colors and their infinite varieties passes through an analysis of the fundamental states of light—black and white, light and shadow:

Le Blanc consiste en un grand nombre de petits miroirs. Le Noir en un grand nombre de petites cavernes sur la surface, ne réfléchissant pas les rayons reçus. Mélangé de blanc et de noir : le gris cendré et semblables, de même le sombre et le brun foncé. Dans l'arc-en-ciel l'ordre des couleurs est : rouge, jaune, vert, bleu, pourpre. Le vert consiste en jaune bleu, il est situé au milieu. (Leibniz & Couturat, 1903, p. 489)

Black and white are not only the ends of the color spectrum, but also active participants in each occasion of the color experience. They serve as “small mirrors” and “small caverns” on the surface of experience. As much as black and white produce a repertory of colors with their infinite variety of mixtures, they also provide the uniqueness of each color experience by reflecting or absorbing light in varying degrees. When we *see* a green, even though we *know* that it is green, not red or yellow or any other color, we *feel* that it is *that* green. In its composition, some of the color’s aspects penetrate into conscious perception (by virtue of mirrors), and some are blocked (due to caverns). In other words, the experience of *that* green is filtered through infinite elements of the composition that fit into the contours of the average experience of greenness. We perceive that greenness as such, but only a small portion of that perception is integrated into our conscious experience, something Leibniz calls apperception. According to Leibniz, the agent of this filtering operation is the sensation itself. Even before I know that that color is green, the sensation of the green composed of infinite tiny movements analyze the different aspects of the greenness in relationship with the combination of other colors, and also according to the convexities and concavities of the refracted ray curves (Leibniz, 1966). Therefore, the tiny movements converge on or diverge from each other, to become conscious perception, carrying their own particularities in each case, hinting their notes, textures, or tones. Leibniz calls these barely perceptual movements tiny perceptions¹⁹. A green is not exhaustible by a clear and distinct idea of greenness, but always emergently a different degree of the clear-obscure, hinging in the same gloomy ground. The inability of consciousness to once and for all absorb all dimensions of the experience in one stroke is also what enables conscious activity for further investigations. That the greenness has already been perceived as such means that it persists under the form of an extra-activity at work

¹⁹ See, Leibniz (1966). *Lettre à Arnault*. In Leibniz, G. W., & Brunschwig, J. *Nouveaux essais sur l'entendement humain*. Paris: Garnier-Flammarion, p. 293.

that makes possible the broadening of points of views, and accordingly, the enlarging of knowledge domains²⁰.

Herein lies Leibniz's deep intuition into the infinite stacking and intertwinement of things, metaphorized as "Arlequin clothing", or "fishes in a pond":

Each portion of matter may be conceived as a garden full of plants, and as a pond full of fish. But each branch of a plant, each limb of an animal, each drop of its humours, is also such a garden or such a pond. (Leibniz & Strickland, 2014, p. 28, §§ 67)

Each portion of matter is traversed by the movements of tiny perceptions at which the features of different beings are articulated with each other. If one is able to follow the perpetual movement in the infra-sensible world in accordance with the principle of sufficient reason, that is to say, to demonstrate the causal relationships among the observable elements that make *this* thing *thus*, but not otherwise (Leibniz, 2014, p. 612, 646), then one can translate the countless complicated animation of things into intelligible form. Tiny perceptions squirm out of the filtering of sensation and become perceptible and then conceivable. A particle has been liberated; so, the tiny perceptions become enmeshed, and their inherent dimensions interweaved so as to become new perceptibilities, and therefore, new functions. Until they acquire their full consistency, they continue to impress, to carry the fascination of the unexpected, and as a result, to stir in as far as another filtering *institutes* itself. So, if one side of Leibniz's enthusiasm towards animalcules reflects the explicit intersection of his concepts with the hitherto revealed dimensions of animalcules; another side underscores the emergence of new questions, some of which fall into the share of the philosopher.

The microscope opens a new world. The discovery of this world, that of the animalcules, lodges diverse elements from technical devices and experimental conditions to certain properties of the selected specimen. All these elements and their coming-together under particular conditions

²⁰ The destiny of tiny perceptions is not bound solely to the possibility of knowledge production. The resistance of matter persists, and sensible properties such as color, smell, taste, texture, shape, etc. carry forward the tiny perceptions' appetite for possible appropriations, despite the incapacity of understanding. In this case, Leibniz affirms the ungraspability of the unexpected that would open the possibility for the consistency of pure manifestation itself to be qualified by Leibniz as another mode of being in its own kind. Serres suggests that this mode of being preserves what is *picturesque* in life. Then, in another step, one might propose that this moment is a modality specific to the field of art.

arrive at a threshold that a spatial distribution finds an expression in the conscious perception. Spatial configuration must now be described in detail in terms of form, movement, or number, and Leibniz himself proposed a micrometrical schema to this end (cited by Serres, 2002, pp. 367-374). On the other hand, the temporal aspect of animalcules is yet to be determined. What would be “its all possible manners in time” (p. 362)? To which kinds of varieties of being, or modalities does this infinite distribution give rise? How do we pass from one scale to another, from one theater to another, with progressive variations? These questions could be thought of as concentrating on one point: the status of the problem. How does a problem emerge so that the distribution of the matter is variationally reorganized in such a way that the constitution of reality brings about new modalities of being?

The Problem of Problem

We have seen that each perception arises from the infinite stirring of tiny perceptions as global effect, perceptions which themselves have an intimate connection with an obscure ground. Whereas each perception oscillates between pleasure and pain, each is constantly modulated by the activity of tiny perceptions, proclaiming themselves by “stings”, a tiny folding taking place at microscopic level. In *Le pli: Leibniz et le Baroque*, Deleuze shows that the stings, in Leibniz’s understanding of tiny perceptions, constitute a constant state of animation that defines a basic characteristic of worry (*l’inquiétude*) for animals (1988, pp. 115-116). Maybe it is better here to translate *l’inquiétude* as concern because it is the main motor for how tiny perceptions are to be selected, and the way in which they compose the global character of conscious perception. The same would hold that some tiny perceptions would be relatively retained in the background, creating a constant instability in perception, and consequentially revealing the problematic character of living itself, as much for the cases of pain as for pleasure. Deleuze analyzes this problematic aspect of the living world in regard to its concerned preoccupations by appealing to Leibniz’s later concept *vinculum*. A problem is what bonds two seemingly disparate dimensions. If conscious perception is constantly washed away by a “smacking” of infinitely small perceptions that variationally hold conscious perception in a clear-obscure continuum, then perception encompasses a partially selected region of the world. This is accorded by the consonance of small perceptions’ movements among themselves as well as the *manners* in which they splay themselves

into the “groundless ground” (Deleuze, 1998, pp. 182-184). The *vinculum* is a tie or a bond, or a membrane, if you will, in which the polyphonous lines of material forces are articulated with each other in a harmonious continuous bass. But we shouldn’t forget that the unity arising from the harmonious holding together of disparate elements is not prefigured but sorted out and overrun by tiny perceptions that will be only momentarily subsided by the tune prepared by the *vinculum*. The *vinculum* serves as a modulatory mobile joint where small perceptions are tended towards a resolution that is the flux of new melodies. Each problem dislocates the *vinculum* in order to resituate it, disaggregates the already composed elements, and polarizes the scattered forces according to the problematic dimensions. It puts the relative inside and outside in contact with each other, extending them and sending them back into each other, providing communication between two zones previously unconnected.

On the other hand, a problem itself acts as a *vinculum*, one where the small perceptions aren’t resolved yet towards functional ends but are suspended in tendential agitations. It is a singular coming together of various elements, enveloping two or more zones coming into each other’s vicinity, acting as a membrane-like sorting-out machine. In other words, a problem is a field in which the problematic conditions wouldn’t give possible solutions without modulating the elements, preparing the very possibility of novelty rather than being a simple obstacle or intellectual engagement. In this way, we pass from an optical model of epistemology to an acoustical model of the problems, defined by “collective echoes”, “the whispering and swarming effects” (Deleuze, 1998, pp. 150-151).

The term “animalcules” is a problematic knot into which several directions of *research* resolve in the vicinity of different fields of activities. Animalcules are here and there, glimmeringly seeking food, avoiding enemies, or attracting partners. When they become observable by human eye, the glimmer takes the form of wonder, to give rise to other forms under other observable properties, provoking new questions. Leibniz’s theory of light echoes Leeuwenhoek’s perfecting of his microscope and experimental environment as the conditions of scientific scrutiny. In other words, “seeing better” appears as a necessary condition of knowing better²¹. If we can better

²¹ Michel Foucault, in *The Archaeology of Knowledge* (2012 [1972]), determines the strict articulation between knowing and seeing as the fundamental character of the classical age. For Foucault, this connection will be broken away with the emergence of modern knowledge, which he finds the first signs in linguistics, political economy, and life sciences. Now, the relationship between knowledge and vision will be defined

understand the conditions in which the experience of vision occurs, we might also understand the conditions of the possibility of knowledge. Conversely, if we can fully account for the observed properties of the object of knowledge, we might sharpen our focus that will serve as the basis for new knowledge. However, as certain areas necessarily remain out of vision, what is observed doesn't totally give itself to knowledge. While vision disappears in the horizon of invisibility, knowledge sinks into the unknown. A variational field installs itself between two limit points, the visibility of clear and distinct points and the obscurity of a gloomy ground, in the case of vision, and the categorical determination of observed phenomena and the impossibility of their exhaustion, in the case of knowledge. As we cannot consume our field of vision, the gloomy ground engulfs us by sparkling more or less clear particles. If there wasn't such transitional leaping in the field of variation, there wouldn't be nuances in vision. Furthermore, two visions wouldn't be distinguishable from each other, and vision would lose its continuity. So, there must be a certain level at which vision, or knowledge, hooks into its impossibility, the groundless ground, making new knowledge possible.

At a certain level, animalcules, as Serres shows, give evidence to, or confirm, Leibniz's elaborations on epistemology; at another level, they appear to question them. The questioning comes under the form of paradox: a question must be at the same time exceptional and universal. On the one hand, it indicates a restriction in the functioning mechanisms, expressible in terms of already existing principles, on the other. As such, animalcules are a question, or better yet, a problematic field in which diverse elements come into series so as to create a sufficient distance from the known properties of the finite world, therefore calling for the production of knowledge. From the power of the microscope to Leeuwenhoek's first animalcule findings, different factors situate themselves as part of a problematic field so as to potentially produce other problems or to be grasped again as a part of other problematic fields.

But animalcules themselves are not pure observation; they are also a philosophical construction in the sense that they bring together diverse elements towards a description of observed phenomena or are situated in a problematic field. While one direction of this problematic

through the asymmetrical transitions among them, rather than representational continuities. Foucault analyzes Velasquez's *Las Meninas* as the manifestation of instabilities, ruptures, and transformation and organization of the *episteme* of the 17th century.

field goes towards rational categorization of animalcules' observable qualities in scientific terms, another direction intersects with already existing philosophical frameworks, luring them into posing new questions. In this movement of ordering of orders, there isn't any privileged point of view at which the series of series must be raised, there is nothing but propagation of vibrations grasped by the elements in which the fields resonate with each other. Knowledge itself is based on an optic model, but when it comes to the birth of new knowledge, or communication between divergent series, Leibniz passes into an acoustic model: from progression of light waves with respect to the reflection or refraction of light to the propagation of vibrations, elasticity, or expansion with respect to the frequencies of sound waves. Contrary to a clear and distinct vision of knowledge, animalcules gesture towards a clear and obscure sensation of echoes. Instead of a biology of microbes, the problem proposes an echo-logy of animalcules.

Distinguishing the logic of knowledge production that will later find its ultimate basis in the *-logies* of microbes (microbiology, bacteriology, immunology, etc.) from its logical repercussions in, between, and through fields, can be said to be an echo-logy. The term was first used by Jean Millet in a study on the philosophy of Gabriel Tarde, in response to Tarde's proposition to replace onto-logy, the study of being, with the study of having or possession, something Millet called echology. He probably found it commodious in terms of the possible implications the term "echo" could have in other aspects of Tarde's thinking. Nonetheless, he returned to the use of the word "ontology" and would not further investigate the potential implications of the term. As we have already seen, the interaction between Leibniz and Leeuwenhoek might be considered as an echo of different problems, and crisscrossing fields, yet irreducible to any of them. Millet's proposition deserves to be examined more closely in the context of Tarde's philosophy, and reconsidered in the case of animalcules.

For an *Echology* of Animalcules: Tarde's Contribution

The term "echology" was suggested for the first time by Millet in *Gabriel Tarde et la philosophie de l'histoire* in a footnote (1970, p. 168; footnote 2), and evoked by Deleuze, again in a footnote in *Le pli* (1993, p. 184; footnote 20). Millet proposed the term in order to draw attention to the originality of Tarde's approach to ontology, which replaces the "study of being" (*l'étude de l'être*) by the "study of having" (*l'étude de l'avoir*). The reason for Millet's choice of the term is

not clear, however. In the first place, in which sense do “being” and “having” come into an antagonistic relationship? How does Tarde conceive the meaning of having, and what kind of research agenda does he propose through this, in the place of the ontology? Secondly, why the word “echo”? Millet doesn’t explicit the meaning of the term or the relevancy of its use in the context of Tarde’s philosophy. Why would the study of having designate an echo-logy? In which way does it make sense to use the word “echo” in the meaning of having or possession; where is the basis of this use in Tarde’s conception of the study of having? Finally, why is this a “logy”? What makes the replacement of ontology by echology a logical enterprise? How does Tarde conceive the logic, or in other words, what is his attitude towards the systematization of thinking?

* * *

Tarde’s proposition to replace the study of being by the study of having firstly depends upon the fecundity of this kind of research orientation. When we focus on the question of being and its modalities, we end up dealing with unsolvable problems, for the modalities of being always come in a package of oppositions:

L’être et le non-être, le moi et le non-moi: oppositions infécondes qui font oublier les corrélatifs véritables... l’opposé vrai de l’être, c’est-à-dire de l’ayant, ce n’est pas le non-être, c’est l’eu. (Tarde, 1999, pp. 86-87)

Instead of thinking being in relation with its non-existent coupling that is non-being, Tarde proposes to concentrate on what being possesses and how it is possessed by other beings. *J’ai” comme fait fondamental l’eu et l’ayant sont donnés à la fois inséparables”* (pp. 86-87). Possessions are never stable; what you have one moment is replaced by another one. Being always oscillates between what it is about to have and what it had (had), creating a never defusable tension in the moment of possessing something. In this way, while having something makes it reappropriable at other moments, all beings relate to each other in varying degrees, and exchange their modes of possessing other beings at the same time. In this sense, the real owner of possessions is a “group of other owners”. Possessing something, according to Tarde, is necessarily an act; an act of appropriating other beings, holding them together with other appropriated beings, under different forms, and in their infinite degrees of appropriation (p. 90). Whereas Tarde extends the study of having into all beings and their interrelations in the Universe, he limits it through the continually

changing capacity of acting in solidarity with diverse elements. But what precisely is the being in this conception? And when a being possesses something, what does it really possess?

The formulation of possession in Tarde is quite simple: “*je désire, je crois, donc j’ai*”. I desire, I believe, so I have. It doesn’t mean that what I desire or believe passes immediately into my possession, remaining there once and for all. But the act of desiring or believing underlines the fact that something suggests itself as desirable or believable: “*des impulsions qui cherchent à se manifester, des « vœux » qui veulent s’exprimer*”. Suggesting itself through impulsion and wanting is possession itself, which will eventually lead to subsequent actions, itself being an action in the sense of indicating tendential movements in multiple directions.

Tarde’s conception of sociality is constituted in this very moment of suggestion that is neither subjective nor objective. Rather, it is a field of forces in which possible paths or directions of action interact with each other, striving to gain actuality, reinforcing or annihilating each other. The consequent action expresses the limit of a force or a group of forces that will potentially give rise to other actions, as a “*force rayonnante*”, a radiating force, and also itself as a culmination of the radiated forces. In this sense, a force is “a relation [*rapport*] between other forces”, defined by its activity, capacity to act in solidarity with other forces. A being, physical, biological, or social, emerges at the limit of forces’ capability to appropriate other forces, as a result of its effort to perpetuate itself endlessly. Being constantly dissolves and resolves, disappropriates and reappropriates its possessions so as to recompose itself. With respect to the movement of forces’ striving to arrive at their limits for composing possessable elements, Tarde determines two fundamental tendencies, or two basic culmination points: creative and critical (Tarde, 1895, p. 112). In either case, the forces effectuate a certain inclination of gathering together, but in a creative tendency in their appropriated form, they perform a combination that is irreducible to the preexisting types. Tarde calls this “invention”. On the other hand, when being is under the suggestion of a critical tendency, it persists in the range of the mechanisms of the dominant order, in their already determined parameters, so as to imitate preexisting types. We shouldn’t forget, however, that the second mode of tendency is also a new composition of forces, in the sense of giving rise to new possessions.

The difference between a creative tendency and a critical tendency is that, in the former, forces not previously positioned in the vicinity of each other come into proximity. While each act,

for Tarde, is creative in its own way, invention responses to a problem. Each being oscillates between two tendencies, “*une affirmation et une négation*”, or “*un but et un obstacle*” (p. 215). Whereas it resolves its hesitation by “*la suppression de l’un des deux adversaires ou de leur contrariétés*”, in other words, by improvising a solution to the problem, being examines or ‘experiments’ with the degree of interfering forces’ harmony. In this sense, each act appears as a prolific moment of interrogation that will crystallize the questions’ inventive character as the basis of creative tendency. In Tarde, the questions, or problems in general, are not simply generative instances in the way of resolution in predisposed solutions. Rather, they are the inherently adventurous character of the universe, not merely reserved to human beings, and cutting across all realms of the universe:

Quand on voit, déclare-t-il, la nature vivante, malgré la contrainte despotique de ses types préexistants, écumer en variétés toujours nouvelles, en anomalies parfois monstrueuses ; quand on la voit, dans l’évolution accidentée de ses créations successives, au lieu de suivre une voie droite et unique, se jeter de côté, et d’autres dans des sentiers multiples dont beaucoup sont des impasses, d’où elle est obligée de sortir par de véritables régressions, on doit convenir qu’elle est mue, au fond, par un impérieux besoin de découvrir et de conquérir, de se lancer en avant, au hasard, à l’aventure. Et ne semble-t-il pas que, en cela, elle rappelle les entreprises petites ou grandes des aventuriers humains ? (La Leçon d’ouverture du Cours au Collège de France, quoted by Jean Millet, 1970, p. 170; footnote 14).

Problems display the dynamic character of possessions. Each possession is in transit to possess other things as a response to a problem, and at the same time a “sign” for measuring the degree of adventureness. For instance, when examining the social field, statistics play an important role. But in order to play this role, statistics should always be put into use considering the composition of flux of desires and beliefs, which are the real aspects of an emerging act. In other words, statistical tools must be integrated into the potential “fecundity” of the question that is the study of having.

Given this, the study of having, following Millet’s term of “echology”, takes on another direction. If each possession is transitory, and the deployed characters don’t cease to pass into each other in each act of appropriation by “accumulated similar small vibrations” that indicate either convergent series (imitation or critical tendency) or divergent series (creative tendency or invention), then a question is situated at the very moment of indecision. In this regard, the question itself might be considered as possession, but a paradoxical one. At this moment of overlapping

forces, small vibrations are imbricated as to propagate each other or behave as an action in distance over each other in an unending process of variation. In the question, innumerable forms of possession come together by “*un entrecroisement de domaines variés, de plus en plus subtils*”, resonating in each other by traversing ages, ideas, promises, fields, disciplines, etc., so as to wrench away from them something appropriable for the dimensions of the question under consideration. In this way, one might argue that the study of having might be considered as the “study of echoes”: a search for yet inexpressible forms culminating at the intersection of desires and beliefs, not reserved merely to human (social) life but crisscrossing all the fields of the universe. Paradoxically, Tarde calls this productive feature of possession “*universelle répétition*”, and determines its different forms in physical, vital, and social fields as “*le rayonnement vibratoire*”, “*l’expansion génératrice*”, and “*la contagion de l’exemple*”, respectively. Now, we can answer the last question. What kind of a logic does echo-logy follow? In which sense can it be called “a” logic?

As we can see, being is defined by its possessions, and has only a vocation of variationally repeating its elements by virtue of their transitory character. In this approach, possession appears at the limit of what had and what it will have been *en route* of propagation and variation. This is another way of saying that, due to their precarious conditions, beings don’t behave according to a predetermined logic, but pose questions as a way of discovering inherent logic of things:

logique est au service de la force et de son rayonnement, et non l’inverse. La logique n’est pas l’art de découvrir la vérité, mais l’art de changer de pensée tant en conservant, sans diminution, la distance qui nous sépare de vrai ou de faux. (Tarde, 1904, p. 136)

This is a logic of adventure positioned at the interval separating the known and unknown, discernable elements (possessions) and undecidabilities (possessables, potential possessions), radiating forces and resonating elements. In this sense, the logic of having is not a systemic or transcendental one that determines elements as already given, but focuses on the dynamics of elements: how many, how together, and what else? Describing possessions in terms of a solidarity of forces, which then acquire a harmonious or disharmonious, convergent or divergent character in the process, logic of possession acts in accordance with other thoughts, fields, and systems:

Un système joue dans un esprit le rôle d’un animal dans un paysage... il n’en existe jamais, à un moment donné, que des fragments et des aspects épars de système, pensée par un ou plusieurs esprits. (Tarde, 1904, p. 418)

The only criterion for appropriating a logic is to consider the fragmentary character of research. Research should be sufficiently adventurous that it enables the accumulation of small vibrations in the setting of the moment of undecidability posed by a situation. Here, it is helpful to emphasize again the relevancy of Millet's term echology. As much it stresses several aspects of Tarde's proposition to replace ontology with the study of having and its modalities, it promises to be thought through, and expanded towards, other conceptual resources. Now, echology can be understood as not only "the study of having", but also "the study of echoes". Constituted through a series of echoes that are always the echo of other echoes, echology becomes a process of multiple seriations. What gives consistency to the seriation of echoes is the reciprocal determination of echoes, their mutual implication and resonance in ideas, thoughts, disciplines, and problems. An echological approach gives consistency to the interval, focusing on transitions, overlapping, and sliding among the elements. The modes of elements' interrelation and how they come together are posited by the question or problematic field, and its unfolding in the elements' dimensions. In this sense, each possession is a reciprocal relationship between the appropriated elements, a mutual belonging, held together by the interval opened by the question, conditioning the field of possible solutions, until arriving at an inflexion point of other questions. This process also displays the problematic character of echology, and its snowballing movement with new questions and new elements. Tarde's proposition for studying the modalities of having promises a prolific starting point for solidarity between different research settings.

Animalcules were one case in which different ideas, approaches, and methods resonated in each other in a pre-scientific and pre-philosophical moment in the interval.

As we have seen, one way of investigating this interval is through Leibniz. The forms that animalcules took in Leibniz's philosophical system led to the suggestion of an echology in a Tardean context. The propositions of a research program that we called an echology of animalcules includes following the different forms and figures of this interval, and in different routes. The relationship between Leibniz and Leeuwenhoek was part of this itinerary, and then Tarde joined them. Each figure and each way station both participated in a problematic field and developed it in its own right by articulating its own problems. The next part will show a bifurcation in the thinking of animalcules. It will offer an occasion to observe with Spinoza how the relations of force and the mutual influences among living beings produce the reciprocal patterning of rhythms.

Spinoza's *Ethics* on the Worm in the Blood

In a letter to Henry Oldenburg, hinting at his awareness of Leeuwenhoek's observations, Spinoza mentions "a tiny worm living in the blood", a metaphorical reference to microorganisms already in use during the 17th century. Oldenburg asks Spinoza how parts of Nature accord with each other to constitute a whole, and how the whole relates to the parts. Spinoza immediately points out that knowing the agreement of *each* party is beyond his knowledge since it is impossible for him, as a finite being, to know "the whole of Nature and all its parts". Then, he argues that the agreement between parts emerges from their adaptation to each other such as to reduce their opposition to a minimum insofar as possible (Spinoza, 1995, p. 192). The first example of Spinoza to explain his argument is the relationship between parts of the blood: lymph, chyle, etc. The degrees of motion of these entities adhere to each other in such a way as to constitute the whole (the blood), integrating a meaningful relationship in each part of a functioning mechanism. With the second example, "a tiny worm living in the blood" (p. 193), things become complicated. Spinoza considers the case from the perspective of a tiny worm, which is "capable of distinguishing by sight the particles of the blood –lymph, chyle, etc.". The fact that the worm is capable of distinguishing itself by sight constitutes it as a separate entity from blood, which makes this case different from the relations between the internal parts of blood, and which explains what makes this an interesting case for Spinoza. The part-whole relationship is instantiated differently in the case of the worm living in the blood because the situation is not concluded and remains open. The worm doesn't only distinguish itself from the elements of blood but is in a position of "intelligently observing how each particle, colliding one another, either rebound or communicates some degree of its motion and so forth" (p. 193). How the situation unfolds will depend on the exchange of degrees of motion among them, resulting in collision, rebound, or communication. In as much as there isn't any cause altering existing relationships in the blood, there is no reason that the mutual adaptation between worm and blood particles would be destroyed. In this regard, the worm behaves just as any other being in the universe, considering "each individual particle of the blood as a whole, not a part" (p. 193), cohering with them as much as possible, as a necessity of its perseverance. But since the worm is not an inherent component of blood, it involves other modes of existence that are defined apart from its relationship with blood. This means that it is open to

all sort of effects of all sort of external causes, just like blood itself is subjugated to other influences and changes as a part of the organism, and therefore, the universe itself. This double resonance entails that the relationship between worm and blood is internally and externally modulated as to produce changing patterns that determine how their relationship would take shape in the future. All the elements, but mainly two sides of the relationship—blood and worm, are open to the perturbation or reinforcement of internal and external factors, through changes in degrees of motion and eventuating communication. In this way, blood, worm, and all sorts of environmental factors constitute a complex of changing rhythms. Unless the presence of the worm in the blood is not felt as a disturbance to the organism, blood and worm have a *tendency* of preserving their existing relationship. Since they already have the exchanges or degrees of motion more or less in concert with each other, they “are reciprocally determined to exist and to act in a fixed and determined way” (p. 194).

Another dimension of Spinoza’s analysis, however, arises as a logical consequence of the whole-part relationship. Blood and worm don’t exist only in their relationship, but both participates in Nature in their own ways:

Now since the nature of the universe, unlike the nature of the blood [and that of the worm] is not limited, but is absolutely infinite, its parts are controlled by the nature of this infinite potency [*potestas*] in infinite ways, and are compelled to undergo infinite variations. (Spinoza, 1995, p. 194).

The possibility of undergoing infinite variations means in the case of the tiny worm living in the blood that all of the elements participating in this relationship open together into a field of indeterminacy in which their relationship varies according to external and internal factors, and are composed and decomposed in infinite ways. The changes in the degrees of motion pose the question of potential in thinking as the necessary accompaniment of variation (distinguishing by sight, intelligently observing):

For I hold that in Nature, there also exists an infinite power (*potentia*) of thinking, which, in so far as it is infinite, contains within itself the whole of Nature ideally, and whose thoughts proceed in the same manner as does Nature, which is in fact the object of its thought. (Spinoza, 1995, p. 194)

The infinite power of thinking, in the case of human beings, takes finite form as knowledge. In another letter to Oldenburg, interpreting Boyle’s experiments with nitre, Spinoza gives insight into

the possibility of knowledge that requires the determination of “all tangible qualities [that of the nitre] ... depending solely on motion, shape, and other mechanical states”. For these determinations not to remain at the level of conviction (the first knowledge in the terminology of *Ethics*), they must be demonstrated in mathematical terms (“one can never confirm it by chemical or any other experiments, but only by demonstration and calculating” (pp. 78-79)).

Leeuwenhoek’s animalcules share a similar position. Observed under a microscope, they were *approximatively* described in terms of their motion, shape, and other mechanical states. Nonetheless, they were not yet fully explained in mathematical terms, nor sufficiently thought in philosophical terms (we don’t know how they behave in different kinds of situations, how they collide, rebound, nor communicate from a Spinozean stance (or Leibniz’s *all possible manners* in time). Yet, Spinoza doesn’t hesitate to discuss this, even if in a letter, as if to indicate some potential lines of research. We have already seen that the whole-part relationship entails a problem of rhythmicity. The accordance of the blood particles might be disrupted or solidified as a result of internal and external factors. Even though the sides are inclined to preserve their existing state, there is always a margin of possibility (*potestas*) that might produce unexpected consequences. Finally, the possibility of transforming an existing relationship amounts to a problem of ethics, the basis of Spinozean enterprise, and preceding even the question of the conditions of possibility of knowledge.

* * *

As the name of Spinoza’s most fundamental book, *Ethics*, implies, all kinds of problems—metaphysical, epistemological, or political, have an ethical basis one way or another (Spinoza, 1985). When two or more entities (individuals) enter into combination, the relevant parts of each other resonate together to inhibit or strengthen the relationships. The immediate polarization of an encounter, as technically characterized by two limits, joy and sadness, resolves into different modes of existence. The classification of types of knowledge in Spinoza appears as inherently attached to the modes of existence. It entails that what we know is immediately connected to our way of being affected by the entity known, immediately polarizing the encounter, functioning as an inhibitor (sadness) or an amplifier (joy) of the experience. The encounter triggers a process of corresponding rhythmic interweaving or patterning towards a mutual opening into a field of indeterminacy in which the possibilities are asymmetrically distributed for both sides in terms of

acceleration or deceleration in degrees of motion. This is precisely the point for Spinoza: as a recent discovery, the worm in the blood allows for the observation of a “case” in Nature. It doesn’t resemble any *known* cases of the part-whole relationship, thus enabling epistemological, metaphysical, and ethical questions initiated by Leeuwenhoek’s observations and descriptions. While explaining to Oldenburg that the whole-part relationships in Nature cannot be *entirely* known in advance, Spinoza mentions the variety of relations into which blood and worm could enter, not as a necessity of their species properties or their formal functions, but in terms of the relations of speed and slowness between particles. Evidently, to understand the spectrum of those relationships, it is crucial that their formal properties be defined and explained in mathematical demonstrations, accordingly, classifying them with respect to the already known properties of living beings. Each new element added to the repertory of known properties reposes the question of composition and decomposition, and their implication in degrees of motion. In this way, new modes of existence emerge as a result of the elements in consideration and their capacity for coexistence or destruction, attraction or repulsion, giving rise to possible “sociabilities”.

While talking about the affinity between Spinozean ethics and ethology studies, Deleuze puts the relationships between individuals as open-ended questions, traversing the plane of Nature, and serving as the basis of social relations:

How do individuals enter into composition with one another in order to form a higher individual, *ad infinitum*? How can a being take another being into its world, but while preserving or respecting the other’s own relations and world? And in this regard, what are the different types of sociabilities, for example? (Deleuze, 2001, p. 126)

Individuals do not only enter into different sorts of compositions, but also new relations arise from these compositions, heralding new social forms: A new sociability individuates from the passages among the relations of individuals in their worlds²². The lymph and chyle are both composed of relations in their world, some of them enabling us to define them as separate entities, for example, in scientific terms. As such, animalcules in the blood suggests that there is a certain composition of relations between animalcules and blood, which are only definable through the known properties of blood and animalcules, observed and described until now. Leeuwenhoek took

²² For an analysis of the problem of individuation in Spinoza, see Rice, L. C. (1971). Spinoza on individuation. *The Monist*, 640-659.

important steps in defining their qualities through their movement, number, and form, associating them with different contexts, and observing their existence in different situations according to the parameters of dirtiness or cleanliness, health or sickness, in different spatiotemporal coordinates.

Although the notion of animalcule was not sufficiently consistent in scientific terms, it had already adumbrated certain modes of existence, pertaining to the world of living beings that will find their proper scientific lineages under the nomenclature of microorganisms and also their place in human life. We have already seen two cases in the philosophy of Leibniz and Spinoza in which animalcules help draw parallels with problems of modality, perception for the former, and the problems of rhythm and ethics for the latter. The scientific study of microbes will later require different figures in the history of sciences, but perhaps the same problems will subsist under different forms. In contact with different philosophical, scientific, social, or political motivations, these problems may persist, more or less disappear to return later, or resonate with other problems.

Throughout this chapter's proposal of animalcules as the discovery of the world of infinitely small creatures, interactions between different fields in different contexts were explored, highlighting how the organization of one problematic field might affect another by producing overflow effects. Thus far, however, it would seem as though the interaction has only been between science and philosophy. However, as the opening scenes at the beginning of this chapter suggests, there is another field where approaches to light take on a completely different dimension: art. How do we now include Vermeer and his approach to light, and implicate him in in the ecological landscape in terms of the conditions that made animalcules possible?

Both Leeuwenhoek and Vermeer didn't miss an opportunity to use the technical facilities of their age for their own aims. The appeal to optical theory for the invention of observational devices—the microscope in the case of Leeuwenhoek and camera obscura-type devices in the case of Vermeer, provides a point of comparison.

How to Interpret a Work of Art: Or the Ungraspability of Vermeer's Paintings

Vermeer, like many of his contemporaries, was interested in both cartography and optics. He was familiar with the studies of important figures of his age like de Vries, Samuel Marolois, Hendrick Hondius, and François Desargues, and the principles of projective geometry and optical

theory (Wadum and Blankert, 1995, p. 67). Like other Dutch painters of the age, he was concerned with how to correctly apply perspective rules and distribute light in the most efficient ways. Especially in his early works (like, *Officer and Laughing Girl* (1655-1660), *The Girl with the Wineglass* (1659-1660), *The Music Lesson* (1662-1665)), Vermeer endeavored to create carefully designed illusions that would orient the gaze of the spectator according to perspective rules. At the same time, he began to discover how light behaves over objects, and its fidgeting, tonalities, or intensities, which would acclimatize him to autonomous character of light (Read, 1951, p. 43). As much as he excelled at his study of optical images' special qualities, his treatments of light, tonal values, shadow, and color helped him create an effect of impartiality. It was as if he observed human beings in their daily activities of making music, reading letters, or working in the market, taverns, homes, and the street without their awareness (see *The Little Street* (1657-1658), *The Milkmaid* (1657-1658), or *Women in Bleu Reading a Letter* (1663)). For example, in *The Procuress* (1656), he used a mirror and a pair of compasses in order to achieve the contours and decorations of the objects. He also experimented with convex mirrors, double concave lenses, and camera obscura-type devices in order to set a particular pattern for the use of optical instruments²³. He rendered visible the embeddedness of the figures in their environment by a free rhythm of light, diagonally traversing all space (p. 43). The more light became autonomous in Vermeer's paintings, the more he was inclined to design more rigorous technics to emphasize his status as observer. According to art historian Daniel Arasse, Vermeer's care for the details of light compositions increasingly distinguished him from other contemporary Dutch painters (Read, 1994, pp. 5-6)²⁴. All of Vermeer's efforts were geared towards capturing the immense details of a scene in one stroke. The ephemeral character of the moment gained a consistency in which light

²³ For two challenging arguments about Vermeer's use of camera obscura, see Fink, D. A. (1971), Vermeer's use of the camera obscura—A comparative study. *The Art Bulletin*, 53(4), 493-505; Wheelock, A. K. (1977). *Perspective, optics, and Delft artists around 1650*. New York, NY: Garland. For an argument defending his use of camera obscura, based on the analysis of the perspective rules found in Vermeer's paintings, see Steadman, P. (2002). *Vermeer's camera: uncovering the truth behind the masterpieces*. Oxford University Press, USA.

²⁴ Maurice Merleau-Ponty emphasizes that this deviation is not simply an arbitrary consequence of Vermeer's selection of optical devices but arises from the gap between his theoretical premises about optical theory and his practice. Merleau-Ponty calls this gap the "Vermeer structure". See, Merleau-Ponty, M. (1969). *La prose monde*. Paris: Gallimard, p. 99.

revealed an object's capacity for reflection or absorption, arising out of infinite varieties of brightness and darkness, and the intermingling of murky, shimmering, and luminous areas.

In her book, *Eye of The Beholder* (2016), Laura J. Snyder compares Leeuwenhoek and Vermeer, focusing on the crucial moments of their lives as well as the climate of the era influencing their work. Snyder explains that both Leeuwenhoek and Vermeer didn't receive a formal training on optics and geometry; both learnt how to create and use optical devices by their own means for their own aims (p. 311). Leeuwenhoek evidently was a curious man, but his real passion was towards optical phenomena, combined with the functioning of visual perception and the activity of lens grinding for obtaining clearer vision. Leeuwenhoek achieved to make the most efficient microscopes of his time, as well as, to a certain extent, combine his observations with the use of measurement devices, initiating a new area of study. He also paid particular attention to experimental conditions, in terms of setting the microscope in certain light conditions, taking notes of his observations, and iterating the same procedures with the same material under the same conditions (p. 309). In his own ways, Vermeer also discovered optical phenomena by constantly iterating the same themes. He observed changes in color perception under different levels of illumination by his paintings (p. 148), insisting on certain patterns and themes. Both Leeuwenhoek and Vermeer used more or less the same geometrical and optical knowledge to create their devices, both strived to tame light phenomena, and both experimented with the same materials, or themes in their fields: "Vermeer using the device (camera obscura) not as a drawing instrument but as an experimental apparatus, not so different from the way von Leeuwenhoek used his microscopes" (p. 311). They investigated optics in their own ways, blazing trails in their fields, and channelizing the obtained results to different ends. "Von Leeuwenhoek and his microscopes, and Vermeer's lenses, mirrors, and the camera obscura, to see beyond the surfaces, beyond the immediately apparent—to see more than meets the eye" (p. 311). In the case of Leeuwenhoek, we already begin to see how the *rationalizable* elements of this surface that had formerly remained unnoticeable. But is this the same surface in question in the case of Vermeer's paintings? How to grasp the "beyond" Snyder mentions, to be able to define how we perceive "more than the eye meets"? Should we search for its origin in optical devices and, if not, how to interpret their use in Vermeer's paintings?

Snyder underlines Vermeer's concern for correctly applying perspective rules (pp. 146-147). Although Vermeer's main objective was not to directly carry optical effects into painting, and in some cases, not to apply the effects of lenses, or to alter results (p. 152), perspectivism allowed him to capture the details of a spatial configuration and associate it with the fleeting moments of daily life. In this way, the effects of the optical devices used were entrenched in the space of painting as a means to construct a mutual complementarity with the elements of observed phenomena. Therefore, what can be seen in the painting becomes interpretable from the point of view of some graspable references such as historical allusions, symbolical meanings, or metaphorical connotations. Certain points are mutually implicated in a system of reference and in a painting; these references make each element in the painting decipherable in historical, political, social, or philosophical terms.

Georges Didi-Huberman, in his article about Vermeer's paintings (1989), addresses a similar issue. He remarks that the interpretative frameworks suppose that a work of art consists of hidden elements, which might only be discovered by the attentive and regardful eyes, one able to catch the details. He calls this attitude "seeing in detail" (p. 135). Seeing in detail provides a *necessary* organon for the interpretation and knowledge of art. In this attitude that might be called semiological or historical, "everything is *almost* or *not quite* 'there'" (p. 141), but this provisional indeterminacy can be eliminated by concentration on a specific detail, rendering other details meaningful in harmonious functioning. Consequently, this brings about discourse, "helping to tell a story or describe an object" (p. 165). The detail comes to the surface, trailing a hidden structure with it.

Didi-Huberman finds an exemplary case of this attitude in Svetlana Alpers' notion of "descriptive surfaces" in *The Art of Describing: Dutch Art in Seventeenth Century* (1983) (p. 144). A descriptive surface universally underpins a painting in the form of "semantic and narrative reflection", "affirming the primacy of the referent, which acts here as an absolute model and origin" (p. 146). In Alpers' reading, the painting is not for telling stories, but for describing "a world that continues beyond the canvas", fulfilling the organization of the canvas in the perception, as "a way of viewing the world (Alpers 1983, p. 27, quoted by Didi-Huberman, 1989, p. 143). Here, the world is understood as deposited in the pigments on the canvas exactly as it is perceived, caught by means of optical devices, and transmitted to the painting. Alpers emphasizes two devices

in particular, the map and the camera obscura, as important for ensuring the mediation between the world and canvas, gaining significance in the visual culture and in the Dutch character of the episteme of the 17th century. For example, Vermeer's *View of Delft* (1660-1661), according to Alpers, is organized "like a map", giving a strong feeling of the presence of human culture in daily life, coloring it in various tonalities as a "celebration of the world" (Alpers, 1983, p. 145). In this way, while a painting acquires an autonomy vis-à-vis technical skills and knowledge already at use, the graphic description of the world as a mapping of the observed world coincides with the metaphysical depiction as the "celebration of the world". Therefore, a significant detail turns into a center of gravity around which all the elements in a painting revolve so as to reveal the metaphysical signification of the work.

Thus, how do we interpret the use of optical devices in Vermeer's paintings? Should we consider them as tools for representing reality as perceived by the human eye, or simply leave them as one element of painting among others, or avail them for describing the invisible aspects of human culture, therefore making them a springboard towards metaphysical postulates? Snyder suggests that Vermeer's main motivation for using optical devices was to experiment rather than to capture the physical effects of light's reflections and refractions: "[Vermeer] used the camera obscura much as the natural philosophers used it: to experiment with light, to investigate and discover its optical properties" (Snyder, 2016, p. 156). These experimentations allowed Vermeer to observe the different conditions of light and space, and the relationship between optical effects and their possible repercussions in painting. Snyder relates the "uncanny feeling" in Vermeer's compositions to this deviation, calling it abstractionism (p. 283). The optical effects in his paintings take on an augmented form in the sense that ordinary boundaries of the objects vanish for the sake of "bold and curious patterns" that cause the loss of "all sense of texture and form". Objects we can detect as "ordinary", though remaining in the limits of recognizability, produce a feeling of unidentifiability, indescribable through existing referential schemes, freeing the elements out of their semantic connections.

Accordingly, what kind of moment is this? Is it a mystical elevation of human experience, realized through the work of art? Wouldn't understanding it as such be another anchoring in metaphysical presuppositions, framing the field of art as the privileged site of the feeling of sublime (in a Kantian manner)? How can we talk about artworks, think and write through them,

without reducing them to signifying regimes of signs, pinned down onto metaphysical postulates, prospectively and retrospectively landed in details? On the other hand, if such a task is possible, how do we then explain the specific relationship of art with knowledge and metaphysics?

In his article mentioned earlier, Didi-Huberman underlines the essential difference between the field of knowledge and field of art, specifically the painting, since “knowing and looking have utterly different modes of being” (1989, p. 135). This difference between knowing and looking as different modes of being gives rise to the divergence between an artwork and its analysis and puts the historian and semiotician in trouble in their search for meaning. In Vermeer’s case, we observe this divergence in the failures to interpret his paintings in terms of optical device effects, determination of symbolical meanings as the basis of artistic enterprise, and the privileged site of assertion and confirmation of metaphysical postulates. Yet, Didi-Huberman signals certain moments of resistance to such postures. The moments at which the narrativization of the elements in the painting fails, systems of representation dissolve into a zone of confusion, and the meanings springing from mimetic contexts get lost in the uncontrolled rippling of objects.

Despite all this, we might still be able to understand what is happening in a painting without necessarily calling for the metaphysical devices ready-at-hand. To explain his point, Didi-Huberman takes the example of Vermeer’s *The Lacemaker* (1669-1670), also interpreted by Alpers. In the painting, we see a woman lace making in full concentration. If we act like a detective of details; we scan the head, hand, and busy fingers of the lacemaker to, finally, arrive at her four closed fingers, injunctively triggering an imaginary needle behind them, metaphorically conjuring “an eye, a pupil, and a quality of pure ‘blueness’ in the coloured, mobile surface on which the hand lies” (Didi-Huberman, 1989, p. 151). It is as if the shoulders, head, hand, and busy fingers, all the elements, are devoted to the spatial but also spiritual coordinates of the painting, all the objects and coloration organized in such a way so as to accentuate those coordinates. To link the elements, and therefore make sense of the painting, it is enough to find a significant detail, such as bent fingers or a needle, around which all the elements are organized. In this way, the painting acquires its exactitude, and delivers us its meaning and position in reality: “As if the techniques of painting aimed at exactness, in the epistemological sense of the term” (p. 144).

But this is not the case if knowing and looking have utterly different modes of being: painting is rigorous or accurate, but never exact” (p. 144). The first thing Didi-Huberman notices

in the painting is not the act of embroidery, nor the elements organized around it, not even the lacemaking woman; instead, he sees a zone closer to the viewer, covering most of the canvas that, consists of threads, supposedly the threads of laces. It is hard to describe this zone as a “detail” since it doesn’t have a meaningful relationship with the other elements, nor involve the clearly delineated boundaries of an object: “it is something like an accident” (p. 153). On the one hand, swimming before our eyes is a thread, extending from lacemaking activity of the woman; a clear and distinct thread, a mimetic thread. There is the accidental thread, on the other hand, “a burst of color in the foreground of the work”, popping up like an inhibition of the painting’s mimetic features, losing its semantic connections by intruding “a signal” or a clue towards which it “infects the whole picture, or affects it... by means of a phantasmatic, uncanny effect” (pp. 153-155). Alpers attributes this skein of vermillion as the failure in the installment and adjustment of the camera obscura, arising from the unfocused spheres in the panorama, at least eliciting a failure of description (1983, pp. 31-32). But for Didi-Huberman, this is a paradigmatic aspect of all Vermeer’s paintings, which unsettles the representative systems, and moreover, predominates the whole canvas. He calls it a pan or patch of painting²⁵, which imitates nothing, but *accidentally* transforms the whole painting into a problematic field, unidentified, yet somehow uncovered:

it surprises us with its essential capacity to intrude... a solitary bearer of meaning, or rather something causing fragments to appear now and then an aleatory fashion, the way seams and veins spring from geological faults on the surface of the landscape, shining up a whole stratum or deposit of meaning... (Didi-Huberman, 1989, p. 164).

The modal distinction between knowing and looking finds its ultimate basis in this patch of painting’s capacity for intrusion. The patch of painting bears a meaning, but its meaning is not yet explainable in terms of the mechanisms of already existing signifying regimes. Rather, it acts like a probing head, spreading out its fragmentary elements in its sovereign mode of accidentality, from

²⁵ Didi-Huberman’s conceptual resources are different from that of this project. He finds these moments of flight primarily in the Roland Barthes’ analysis of photography. See Barthes, R. (1980). *La chambre claire: Note sur la photographie*. Paris: Cahiers du cinéma, Gallimard, Seuil. In Didi-Huberman’s understanding of the interruption of interpretative frameworks, the unexpected entry of non-resembling bodily intrusions intersects with Freudian symptomology in his dream analysis, and underscores the moments of non-communication, as analyzed by Georges Bataille in terms of a paroxystic mask in which “chaos becomes flesh”. See Freud, S. (1900 [1959]). *The Interpretation of Dreams*, Standard Edition, Vol. IV, London: Hogarth Press and the Institute of Psychoanalysis; and Bataille, G. (1970-9), ‘*Le Masque*’, *Oeuvres complètes*, Paris: Gallimard.

the uncanny feeling of the viewer to the efforts of problematizing, and traveling back and forth in-between. To phrase it differently, it hits the world as “a virtual explosion” (p. 153), scattering its unmediated elements detached from their semantic bonds, set off on a quest of new connections, and new meanings. The patch as an event produces a potentiality, though consistent in itself, not yet consistently situated in thinking and writing. As much thinking of an artwork’s potentiality strives thinking its specific modalities in its situated singularity in writing as it becomes an event in its own right.

In this respect, the problematic field arrives at its absolute autonomy in the field of art in its difference from the already known field of problems, making the inimitability of problems feel their highest intensity. “Something happens, passes, wanders around in the space of representation and resists being ‘included’ in the picture because it creates a detonation or an intrusion” (Didi-Huberman, 1989, pp. 164-165), yet we are able to understand it. Furthermore, we are agitated to dig it up more, to fly off with it without landing on the first track of meaning to appear... as long as the adventure maintains its freshness, as long as once exploding, it explodes again by scattering its buds all over.

For an Echology of ...

It seems that the analogical gap between animalcules and other fields can be said to be *almost* irreparable in the field of art. When Leibniz mentioned animalcules in the purview of his philosophy, he and Leeuwenhoek were *more or less* talking about the same things. While Leeuwenhoek approached science in the Baconian style of the 17th century, focusing on the categorization of the properties of observed phenomena, Leibniz was mostly interested in epistemological questions, the possibility of knowledge, how it would be arrived at through some scattered information fragments for the construction of objective knowledge. Even though Leeuwenhoek presented valuable insights into the world of animalcules, he was only describing some entry points for the complicated spatial configurations of this world, but the next issue would be to think the infinite temporal manners of their existence. However, temporal manners and spatial configurations are problematically articulated with each other as founded in the organization of perception. Knowing and seeing echo each other in the barely perceptible tiny perception’s striving to become conscious perception. To know better, one should see better, and

vice versa. In this sense, the microscope was a very important invention. However, rather than closing all metaphysical discussions, it presented occasions for asking new philosophical questions by opening a new perceptive field.

With Spinoza, this problem of spatiotemporal articulations becomes a problem of rhythm. Mentioning the animalcules as tiny worms living in the blood, Spinoza underlines the complexity of the part-whole relationship, consisting of the patterning of relations between elements, their resonance in an open whole, resulting in harmonious or disharmonious paths. Since the outcome of the pattern is never foreseeable in advance, elements exchange with each other their degrees of motion, speed and slowness, creating tonal and atonal rhythms in the oscillation of their augmented or weakened efforts. Thus, each living entity (or being) is defined by its modes of existence, negotiated all the time by changing rhythms, resonating in Nature altogether. In this way, Spinoza planted the first seeds for thinking the animalcules, that is to say the world of microorganisms, from an ethical point of view. Our ways of integrating animalcules into our lives, the effects of the results of scientific studies on this, but also their interaction with other fields of activities culminates in the constitution of different sociabilities.

Finally, Leeuwenhoek and Vermeer shared the same technical skills, and a passion towards the creation of optical devices. But this passion was oriented towards different ends, towards the observation of nature and rationalization of what has been seen for the former, and contemplation of the conditions of light and depiction of what has been seen for the latter. In the case of Vermeer, depiction of reality took strange forms in his paintings. Emerging like an abrupt interruption of existing interpretative frameworks, a potentiality made itself felt, but not yet construed in terms of existing relationships, and posed as an open-ended question. For all these reasons, it was not optical devices that would explain the works of Vermeer, but the felt potentials that problematize all the elements of the work in its own terms.

* * *

This chapter was designed as a thought experiment using Leeuwenhoek's proposition of animalcules. It aimed to follow the conceptual instability of the term animalcules and its quasi-scientific status to think and feel through its repercussions in philosophy and art. Like every

thought experiment, it took some detours, entailed different axes, to yield, unexpectedly, the methodology of this research and its core problematic character. By “problematic” character, I mean that, within each resonance of animalcules within another field, philosophy and art, we come across a certain description of the problematic character of living. At the same time, however, animalcules echo different problems in Leibniz and Spinoza, to finally, with Vermeer, end up with the problem of the irreducibility of art into the world’s already existing sites of meaning. The term echo-logy aims to observe the movement of resonations between different problematic fields and further their questions towards other problematic fields or new questions. Echology comes from Tarde’s thinking and means “the study of having”. But at the same time, the literal sense of the term “echo”logy also makes way for the investigation of problematic fields through the entanglement of heterogeneous elements. “Echoing”, a verb state that describes the transitivity among different problematic fields amounts to a snowballing intermingling of problems.

Consequently, the proposal to make an echology of animalcules as a result of the thought experiment can be considered now as accompanied by an echology of the relationship of artworks produced with or about microbes, with microbes. This is a good moment to eliminate that awkward expression “the relationship of artworks produced with or about microbes, with microbes” and replace it with what I call an echology of “microbe-artworks”. The use of the word microbe in the term “microbe-artworks” is not an adjective qualifying the status of artistic engagement with microbes. Rather, microbe and artworks come together in the hyphen, which separate and connect them in the problematic of “microbe-artwork”. In this sense, rather than a generic expression, the term is a question: “microbe-artwork?”. What is happening *between* the artworks in question and microbes? How does a specific artwork, or a group of problematically related artworks, “work”? How are they composed of certain elements that bring into fore certain aspects of scientific activity? What kinds of influences will propagate from a scientific entity primarily defined by rational categories? Additionally, if we turn the picture inside out, what are the elements irreducible to the sciences? What else do we find in their engagement with microbes, paradoxically scientific, non-scientific, or extra-scientific? Which aspects of the sciences exceed their linguistic, terminological, and methodological boundaries when they become something else at the hands of artists?

For an echology of microbe-artworks.

Chapter 2

Before the World Collapses: A Microbe-Aesthetics

Art practices that aims to produce beautiful images of microbes by means of biological laboratory conditions present an interesting case from the perspective of art theory, as well as in regards to the manifestation of the internal tensions of scientific discourses' transformation. Microbes, once considered only as the indisputable enemy of the integrity of the animal/human body, now become an object of contemplation through the production of beautiful images. The work of Elaine Whittaker is situated at this paradoxical intersection of our sufficient reasons for finding microbes beautiful and their devastating effects. In *I Caught It at The Movies* or in another naming *Ambient Plagues*, Whittaker observes this situation in plague disaster movies by capturing the characters' fearful face expressions. Putting these images alongside beautiful images of growing bacteria, visualized by the aid of microscope and digital camera, Whittaker hopes to "lessen the fear by embedding it psychologically as beauty in the viewer"²⁶. In another work *Shiver*, Whittaker recognizes "an uncomfortable dialectic" between the beauty of a "created" organism and the shocking aspect of plagues. The "organism" hangs from the ceiling, glimmering with grown salt crystals and red "mutation", composed of over two thousand petri dishes, it glows like a chandelier. The plague, represented by a series of salt encrusted grids with red lines rising and falling, is based on Ebola statistics from Western Africa, United States and Canada, and refers to the security and surveillance systems organized around the potential threat of a pandemic²⁷. Two contrasting feelings, beauty and fear, come together and overlap in the production of images pertaining to life and death. Different scientific conceptions of microbe bifurcate in pandemic movies. However, cultural mediation underlines the material processes, biological and historical,

²⁶ <https://www.tusslemagazine.com/elaine-whittaker>. Accessed 5 August, 2019.

²⁷ <https://www.clotmag.com/key-artists/elaine-whittaker>. Accessed 5 August, 2019.

giving rise to two different, but somehow connected paths. The fictionality of pandemic movies finds a certain basis in the historical construction of the notion of microbe as a pathogenic agent.

Whittaker's *Ambient Plagues* and *Shiver* provide an occasion for examining the transformation of the term "microbe" until its implication in epidemics. There is no doubt that Whittaker's representation of microbes as beautiful living beings is influenced by contemporary biological discourses. However, in this chapter, I will not dwell on contemporary biological discourses and practices that condition the very possibility of contemplating microbes as beautiful creatures. Instead, I will suggest that epidemics are the events that carry microbes into the limit of what they can do and play a certain role in the appropriation of microbes as an aesthetic object. I will show that the tension in Whittaker's works is already inherent to the historical-material processes through which the term microbe moves in a certain pathogenic scientific conception and in different contexts. I will draw a line from the birth of the pathogenic conception of microbes to the manners of confrontation of institutions with epidemics. Between the production of pathogenic discourses and their articulation in scientific and political consideration of epidemics, I will focus on how microbes come into play between normal and pathological, and the kind of understanding of life and definition of living beings it corresponds. My main purpose will be to show that the term microbe is never a unidimensional notion, even in its most scientific characterization, it involves its own countercurrents. On the other hand, the initial scientific categorization of microbe prepares an essential context as their destination: disease. This ties the fate of microbes to the fate of the clinic. The way microbes are taken into consideration changes with the transformation of the clinic. While microbes constantly show their uncontrollability in the context of diseases, these effects are strengthened or weakened by other factors in the organization of the clinic.

At this point, I will rely on Michel Foucault's analysis in *La Naissance de la Clinique* (*LNC*) (1963) to demonstrate how two different tendencies emerge and interact with each other in different contexts in terms of the apparition of microbes. While a tendency pushes the interaction between fields towards absolute control of microbes that becomes visible in the clinic through the phenomena of disease, a tendency of flight becomes visible, for instance, in Xavier Bichat's pathological anatomy, where life and death penetrate in each other in the concept of tissue. On the other hand, the two tendential lines emerging in this analysis are crystallized as opposite poles in the case of the epidemic. I will observe how they intersect, this time through Foucault's *Surveiller*

et Punir (1975). In this analysis, while one line leads to the birth of a new power diagram, the other one explicates an affinity between the question of outside and question of “what can microbes do?”. My main argument is that microbes become an aesthetic object only through such an encounter with an outside. At this point, I will briefly turn to the traditional questions of aesthetics through Immanuel Kant’s elaboration on the feelings of beauty and sublime as the two main outcomes of the aesthetic judgment. Finally, I will carry the discussion into the “uncomfortable dialectic” in Whittaker’s work in order to ask the question of the condition of possibility of a microbe-aesthetics.

Microbes: Death, Disaster, and Fear?

Leeuwenhoek was fascinated by what he saw under the microscope through which he looked at bee stings and spermatozoa. He kept detailed records of his animalcule observations, tried to quantify and categorize them as much as possible with respect to number, duration of motility, typology, and interaction. Finally, when he was able to grow and multiply animalcules *in vitro*, he prepared the conditions for a theory of microorganisms as agents of infectious diseases, later proved right by Louis Pasteur and Robert Koch. In the 1860s-70s, Pasteur demonstrated that life did not originate spontaneously, but needed “germs” to develop; by preventing mould from growing in boiled broth, he showed that life required germs from the “air”. He found that fermentation was a living process, and the growth of different microorganisms on different substrates might, under proper conditions, lead to the production of lactic acid or alcohol, eventually showing the existence of anaerobic organisms (Crawford, 2007, p. 166; Mutsaers, 2016, p. 59; de Kruif, 1996, pp. 52-97).

Koch’s contribution to the consolidation of microbes’ scientific status was also crucial. He demonstrated that a square bacillus was the cause of anthrax, a very contagious disease. Reproducing microorganisms in artificial media, he inoculated them into a healthy host. As a result of this procedure, the test subject fell sick, which proved that the main reason for the disease was inoculated microorganisms. Koch’s discovery solidified the representation of microorganisms as creatures hostile to the integrity of the body and the main agent of infectious disease.

The success of Koch's method enabled him to outline some postulates that would predominate the study of infectious diseases in the future. To demonstrate a causative association between a specific microorganism and a specific disease, the microorganism in question had to be:

- a. Found in the body in all cases of the disease;
- b. Grown in pure culture;
- c. The cause of the same disease when introduced into another organism; and
- d. Retrieved from the second infected organism.

With Koch, the preliminary categories required for the scientific study of microbes were constituted and put into use in scientific methodologies, signaling the completion of animalcules' life span, and their relegation to a curious footnote in the history of life sciences. Today, we understand that the entities examined under the name of animalcules were not tiny versions of animals, but a totally different class of living beings altogether. Germ theory was much debated when it was first suggested, but by 1905, when Koch presented experimental evidence on tuberculosis, it had found its validation. The term "germ" then became the prevalent option for referring to these creatures. However, the fact that they were only detectable under a microscope enhanced "microorganism" as the term used in the scientific community. A spate of microbe discoveries followed, so that by the end of the 19th century those causing diphtheria, typhoid, leprosy, pneumonia, gonorrhoea, plague, tetanus and syphilis had all been identified. It is important to note here that that the context of disease outweighed other relevant contexts of microorganisms (such as fermentation or their use for the industrial purposes, etc.), which had also promoted the use of the term "microbe". If Pasteur with his experimentations on fermentation had opened a new path for microbes in the production of cheese, wine, etc., then Koch and other bacteriologists had sealed the destiny of microbes by showing that they may create an upset in the equilibrium in human organism. In this way, microbes became analogous with disease, disability, or death. But like all destinies, this destiny too would also to be unsealed, taking its time but eventually occurring.

The discovery of microbes' destructive powers disfavored Hypocrites' widely accepted idea that nature was bestowed with a healing power, and that the most effective cure for diseases was one that mimicked nature most successfully. According to this approach, a disease arose from an imbalance in natural conditions such as weather ("the bad air") that created an imbalance in the constitution in an individual's body since natural characteristics corresponded to "the nature of

man in general and of each individual and the characteristics of each disease” (Lloyd, 1983, p. 100). When physiologist Claude Bernard demonstrated that the animal body did not only break down substances such as sugar, but also produced them by means of the internal organization of the body and its own functioning, he did not only invalidate Hippocratic assumptions, but also provoked important consequences in the study of microbes (Landecker, 2007, p. 76). Bernard (1974) argued that the physiological and chemical powers of an organism provided a continuous normal function through which an inner environment sustained itself in a stable way by minimizing the influence of exterior conditions. As long as the animal body was capable of producing an “internal milieu” by virtue of the functioning of blood vessels, nerves, and respiratory organs, which was adjusted in relation to an “external milieu”, it would lead an independent and sustainable life unless disrupted by an external influence it can overcome by internal means (Jacob, 1987). Following Bernard, Pasteur understood the internal milieu as a site of disease that was interrupted by “foreign invaders” whose existence had been attested by Koch (Pasteur, 1878, pp. 1037-1043)²⁸. Both Pasteur and Koch conceived infectious diseases as invasive events, which emerged from the activity of microbes. They suggested that their activity must be considered both from the perspective of the reaction of the invaded body and the disease-inducing qualities of the invaders. For the former, the body of the organism, its internal milieu, had to be described in terms of the disrupted activities of the affected area, manifesting themselves as symptoms, and enabling us to make distinctions between diseases. The observed differences between symptoms as well as disease inducing factors helped classify microorganisms. This in turn helped to establish a diagnosis and rational connections between internal and external milieu. Therefore, in Bernard’s physiological pathology, the radical boundary between disease and health dissolved into a difference of degree. For him, organic and inorganic matter and life and death are situated in the same continuum (Canguilhem, 1966, p. 37).

²⁸ Inga Mutsaers, in her book *Immunological Discourse in Political Philosophy: Immunisation and Its Discontents* (2016), notes that Koch exported his conception of medicine from the geopolitical domain parcelled according to a dichotomy of invading enemies and defending individual human body. Human body became understood as a battlefield against invaders, a site of resisting infectious diseases as invasive events whose main agent of invading force is bacteria (Koch, 1890a, p. 383, quoted by Mutsaers, 2016, p. 31).

In conclusion, the implication of microorganisms in infectious diseases constitutes a paradoxical situation for human beings. At this point, the conditions that threaten the organismic integrity of the human body might only be understood only with respect to what threatens it. As Canguilhem has underlined, in this pathological understanding of microorganisms, biological laws were necessarily designated through the negative image of threat, parasite, and degradation, defining and attributing a negative value (“*valoriser négativement*”) to microbes. However, in scientific discourse, this didn’t lead to a theoretical investigation of microbes as separate from the context of disease, at least not yet (Canguilhem, 1992, p. 112). The *at least not yet*, rather than being a historical delay, was the irrefutable and indispensable encounter of life sciences with the deadliness of microorganisms. The paradoxical status of microbes that arose from the necessity of understanding their threatening status had been installed at the very heart of how we understand disease, in turn, giving birth to a research agenda for examining the “concretely lived life” of microbes (p. 112). But is it possible to *understand* microbes, except under the conditions of biological laboratory? Would the theoretical valuation of the “life” of microbes really be helpful in terms of our understanding of disease and laws governing the mechanisms of living beings? The tension between internal and external milieu, vitalism and mechanism, normal and pathological, and finally, life and death would penetrate from the specific conditions of biological laboratory milieu and spread into the whole social field.

The Complexity of Pathogenicity of Microbes: The Concept of Milieu

Canguilhem traces the discontinuities of the history of life sciences, weighed according to different focuses of analysis, at the passage from the 18th century to the 19th century. For Canguilhem, biology arrived at fully consistent scientific status with the interiorization of its tensions and by the delineation of the regularities of vital processes, immediately burgeoning some irregularities. While mechanist approaches came to the fore with the formalisation and constitution of the theories of organism that integrated the functioning parts of the body in an infallible whole, an element of unexpectedness, designated through notions of error, anomaly, monstrosity, disease, or death, always unsettling the overarching panorama of mechanist approaches. This in turn gave

rise to vitalist approaches, focusing on the contingencies of vital processes, inexplicable by mechanistic schemes.

Thus, at the turn of the 19th century, biological approaches to life oscillated between mechanism and vitalism, and its objects of analysis hesitated between stability and instability. Biology fell into a zone of indecision at the critical historical moments of scientific scrutiny, which has already been taken into account as the engine of the progress of the sciences by Canguilhem's masters Jean Cavaillès, Alexandre Koyré, and Gaston Bachelard. The more symptoms were associated with a particular disease such as pest, cancer, zona, or diabetes as species of organic disorders, the more the environment of microorganisms was described in terms of constant agitation, constantly creating threatening situations for human beings (Canguilhem, 1989, p. 35). In scientific conceptualisation, risk and threat had thus become indispensable aspects of microscopic life, and the pathological the complementary dimension of the normal functioning of organs. As much as a living being was able to respond to the changing conditions of its environment, it reproduced norms, "extend[ed]" and "exhibit[ed]" to the situations in the *middle* of its environment and body. In this way, it opened itself up to risk, "outside, beside, and against" the norm. Canguilhem defines norm through what escapes from it, and "pathological" as the presentation of different norms rather than their absence (p. 166). In contact with the imminence of the pathological, living beings find themselves in precarious conditions and a state of vigilance. Each time, they resolve the tension between the normal and pathological according to the dimensions of their challenged experience (*l'épreuve*). From this optic, the fact of being born itself can be considered as an opening to risks and threats, an exposure to death and disease²⁹ (p. 35).

²⁹ "Ma blessure existait avant moi, je suis né pour l'incarner". These lines attributed to writer and poet Joël Bousquet strangely evoke Canguilhem's epistemological reading of the history of sciences through the conceptions of disease and pathology. Being open to infectious diseases or "wounds" is not a contingent factor of life to be tolerated or repaired, but the very condition that makes any vital process possible. In her recent book, *La créativité de la crise* (2020), Evelyn Grossman discusses the works of Bousquet in terms of the relationship between creativity and personal crisis. She also shows, through Deleuze's reference to Bousquet's in *Logique du sens* (1969) and in *Dialogues* (1996), that these lines actually don't belong to Bousquet, but are a kind of paraphrasing of one of his commentators, René Relli. "Dans son article, René Nelli écrit: "Ma blessure, disait-il, existait avant moi: je suis né pour l'incarner." Ce "disait-il" est omis chez Deleuze. Le propos serait donc rapporté, voire extrapolé de l'œuvre. Nelli n'en donne pas la référence" (*Les Éditions de Minuit*, p. 26-27, footnote 19).

What happens then in the case of infectious diseases? From the pathological perspective of the 19th century, on the one hand we find an organism attacked by a hostile entity, and on the other, an extrinsic mechanism committed to corrode, and eventually, destroy the integrity of the body. As Canguilhem suggests in *Écrits sur la médecine* (1989), the etymological meaning of the word *guérir* intersects with this approach to disease, and in the pathological understanding of microorganism:

Il est assez connu, par l'étymologie, que guérir c'est protéger, défendre, munir, quasi militairement, contre une agression ou une sédition. L'image de l'organisme ici présente est celle d'une cité menacée par un ennemi extérieur ou intérieur. Guérir, c'est garder, garer... Et l'assimilation de la guérison à une riposte offensive-défensive est si profonde et originaire qu'elle a pénétré le concept même de maladie, considérée comme réaction d'opposition à une effraction ou à un désordre. (Canguilhem, 1989, p. 93).

However, in this asymmetrical distribution of offensive-defensive, where on the one side we have an entity whose only task is to attack and invade, and on the other an organism as a fortress whose borders are constantly transgressed, the notion of value straddles both. Without this aspect of value, a microbe would not have reason to attack another living being nor a living being the ability to return to its healthy condition. For Canguilhem, this is the essence of being sick: constantly losing the norms of healthy conditions as a necessary result of the fact of being alive (health as a luxury—*“la santé c'est le luxe de pouvoir tomber malade et de s'en relever”* (1992, p. 167)), and reinventing them as the necessary outcome of the uncertainty of process. The biology of the 19th century conceded in assuming the significative character of living beings, which was a certain capacity of organizing an environment, and taking actions in order of values. In this context then, pathological life examined in the laboratory turns into an investigation of “life itself”: *“Vivre c'est rayonner, c'est organiser le milieu à partir d'un centre de référence qui ne peut lui-même être référé sans perdre sa signification originale”* (1989, p. 147). Negative references to microorganisms as pathological entities or agents of disease were turned into an affirmative image, at least affirmative enough to problematize their lived experience and intricate relationships with their environment.

Canguilhem traces the scientific lineage of this entanglement of mechanical functioning of living organs with their embeddedness and changeability in surrounding conditions through the concept of milieu. This concept, which has, according to Canguilhem, become an indispensable category of contemporary thinking (1989, p. 129), found different conceptual characteristics in

important figures of biology, from Charles Darwin and Jean-Baptiste Lamarck to Geoffroy Saint-Hilaire. For example, Lamarck referred milieu to fluids like air, water, and light as the englobing circumstances of living beings, which characterizes their life conditions. Saint-Hilaire considered milieu in terms of the ambiance in which living beings find and adapt themselves in regards to indefinite exterior relationships, presenting coefficients for certain paths of actions (p. 134). In this respect, two important thinkers were important to Canguilhem, Jacob Johann Uexküll and Kurt Goldstein, figures who also took the attention of other contemporary philosophers, Deleuze and Guattari, in the case of the first and Maurice Merleau-Ponty, in the second³⁰. What was interesting in Uexküll and Goldstein for Canguilhem was their conception of life based on the composition and making of milieu. Their conception of milieu did not depend on a predestined site of meeting between the exterior relationship of pre-constituted entities in their environment and interiority of relations in the presupposed body. Instead, for Uexküll and Goldstein, milieu was an active interweaving of biological relationships whose terms exchanged roles (p. 144)³¹. A living being, above all, was defined through its singular individuality; tested in various occasions, its life is made of “failure” or an “essay”, an “error” or an “adventure” (p. 159). With Uexküll and Goldstein, Canguilhem discovered the problematic character of living beings and life itself away from the context of disease, but still as an extension of the mutual implication of normal and pathological. Now, normal was no longer designated only in relation to the dichotomy between health and disease, and pathological as an attempt to return to assumed norms. Instead, normal and pathological could now be understood as both together constituting whole field of life, a series of dynamics between dissociation and resolution, destruction and invention, catastrophe and flourishing.

Another important conclusion that Canguilhem draws through Uexküll and Goldstein is the determination of the gap between the milieu of living beings and the milieu of biological

³⁰ For example, see Deleuze, G., & Guattari, F. (1980). *Mille plateaux: Capitalisme et schizophrénie*, 2. Minuit, p. 67; p. 314; Merleau-Ponty, M. (1976). *Phénoménologie de la perception* (1945). Librairie Gallimard, Paris, pp. 119-144 and *passim*.

³¹ “Entre le vivant et le milieu, le rapport s’établit comme un débat (*Auseinandersetzung*) où le vivant apporte ses normes propres d’appréciation des situations, où il domine le milieu, et se l’accommode” (quoted from Goldstein in Canguilhem, G. (1992), *La connaissance de la vie*, Vrin, p. 146).

laboratory. A laboratory is a privileged site for the examination of vital characteristics for the purpose of deducing mechanistic principles. A living being that is studied in a biological laboratory can display characteristics and behaviours as much as the laboratory conditions allow them to display:

étudier un vivant dans des conditions expérimentalement construites, c'est lui faire un milieu, lui imposer un milieu. Or, le propre du vivant, c'est de se faire son milieu, de se composer son milieu. (Canguilhem, 1989, p. 143)

The difference between composing and imposing a milieu is what opens the gap between life and laboratory conditions, milieu as a life environment and milieu as laboratory environment. Life, however, is always more than what is attributed to it, explained by scientific schemes. In this account, “life itself” is not a hypothetic, vitalist principle which provides a transcendent origin for mechanistic principles but is an indispensable aspect of the meeting between oscillatory poles of mechanism and vitalism. The oscillation of poles displaces them so as to pose the possibility of distribution of unexpected elements on the continuum. This, in turn offers ways of asking new questions in the scientific setting, resulting in the emergence of new laws and principles. In this regard, we also cannot say that the milieu of living beings and the milieu of laboratory are totally disconnected, and that scientific results obtained from experimental laboratory conditions are merely artificial products of the human mind in the form of representational bits of information. However, this is not Canguilhem’s point at all. By positing the interdependence of the normal and pathological discussion in the context of milieu, and its different historical and philosophical elaborations, Canguilhem aims to show the intricate articulations and ruptures between different types of milieu. Each experimental scientific setting brings into the laboratory the breeze of living being milieu, each time, producing certain combinations of arbitrariness and determinedness. Living being behaviors are not totally left to the mercy of chance, nor are exhausted by the explanatory schemes provided by scientific activity. In this sense, rather than assuming an absolute dichotomy between living being and laboratory milieu, Canguilhem emphasizes the dynamism of milieu in which a milieu is always a milieu of milieux as each action now obtains the dimension of event:

Rien n'est pas hasard, mais tout arrive sous forme d'événements. Voilà en quoi le milieu est infidèle. Son infidélité c'est proprement son devenir, son histoire (1966, p. 131).

Once a milieu is defined through the presupposition of its infidelity, all the discussion about the articulation of lively characteristics through mental representations changes direction, sinking this supposed duality (which haunts all modern thinking) into the complexity of an immanent field. What defines a milieu, under life conditions or in a specific laboratory setting is the resistance to conformity to the expected schemes. As Canguilhem underlines again through Goldstein, a milieu is defined through “*des fuites, des trous, des dérobades et des résistances inattendues...*”. In this way, Canguilhem maintains both continuity and discontinuity, succession and rupture, consistency and inconsistency in the passage from so-called “natural” to laboratory conditions. He relegates the gap between them to the priority of lived experience “explained” but not “cancelled out” by science (p. 131). As Nietzsche is fond of saying, *les mains de fer de la nécessité qui secoue le cornet du hasard*.

A biological laboratory is itself a milieu for a living being under consideration. It restricts and frames life conditions by depending on historical and philosophical presuppositions. Nevertheless, within each reproductive process of referencing and experimenting, life confronts with the infidelity of the milieu, therefore reinventing the normative order. The polarity of normal and pathological meets with the polarity of life, cutting across all planes simultaneously:

... le fait pour un vivant de réagir par une maladie à une lésion, à une infestation, à une anarchie fonctionnelle traduit le fait fondamental que la vie n'est pas indifférente aux conditions dans lesquelles elle est possible, que la vie est polarité et par là même position inconsciente de valeur, bref que la vie est en fait une activité normative (Canguilhem, 1966, p. 77).

For Canguilhem, once life's fundamental polarity between normal and pathological coalesces into itself in the continuum of degrees of interpenetration, the normative order of living beings ceases to be defined in negative terms, obstacle, lack, and degradation. The occasions of life issue a call for “essay” or “adventure”, singularly polarized depending on the dimensions of events in the complexity of the milieux, each time hitting the field of life with their infidelity.

In Canguilhem's *Le normal et le pathologique*, it is not hard to see how the pathological approach to microorganisms would find its repercussions in the social field for it basically depends on the conception of hostility. The pathological mobilizes a logic of eradication and shielding a defense mechanism: detect and destroy. In contrast, the life conditions of microorganisms,

considered earlier through their act of composing their milieu, are kept in the background, almost as if in a state of inexistence, irrupting only in critical instances. Meanwhile, pathological contexts, which can be seen as dwelling beyond the scope of experimental laboratory conditions have become increasingly more integrated into regulatory political mechanisms, spreading into the social field with some unforeseeable consequences. Canguilhem confines himself to determining the epistemological repercussions of projecting normal and pathological into the same continuum. He points in the direction of opening another spectrum which redistributes the continuities and discontinuities in the social field as a whole.

The pathogenic understanding of microbe would become an integral part of the organization of the clinic under the form of disease. From the perspective of being part of a wider social plane than the laboratory, in what kinds of situations do the life conditions of microbes appear in restrained or unexpected ways? What forms of expression would they get under these new conditions? Which conditions allow for the reproduction of the same properties or lead to the creation of new ones? And more importantly, what aspects of the social plane give rise to new modes of microbial relationship? For answers to these questions, another historico-philosophical-discursive elaboration is needed, Foucault's analysis of the clinical gaze's transformation from the 18th to the 19th century gives us some hints in that direction.

Microbe Enters the Clinics

Despite their totally different methodological priorities and philosophical tasks, there is a strange continuity between Foucault's *La Naissance de la Clinique, Une archéologie du regard medical* (1963) and *Surveiller et Punir, La naissance de la prison* (1975) where the analysis of epidemics is not the main focus though appears in some critical moments. In *LNC*, the epidemic analysis is narrowed down to an epistemological articulation between seeing and knowing, deposited in the "archive" of the clinical gaze. The clinical gaze, which Foucault threw into relief according to a methodology called archeology, points to the inseparability of the treatment of diseases in clinics from scientific perspectives. In this analysis, the epidemic appears as an event that interconnects many areas on the clinical surface. In *Surveiller et Punir*, epidemics are analyzed in terms of a shift in power diagrams, this time according to another methodology called

genealogy. A plural and sometimes contradictory past reveals various truth regimes by the operations of articulation between power and knowledge.

Following Foucault's two different epidemic analysis over two distinct periods, we can identify two unique lines of research, and tendential planes of microbes' positioning in different truth regimes. On the one hand, with refinement of the clinical gaze, increasing coordination between different fields of activity gradually minimizes the element of unexpectedness that arises from the different sorts of engagement with microbes. On the other, the main factor causing this development is the resonance of these elements of unexpectedness immanent to each field itself. Thus, the epidemic paradoxically implies both the opening of a horizon of absolute control, that is, the emergence of a new power diagram that posits controlling the element of unexpectedness as an aim, and the absolute externality of the microbe, that is, its contact with an outside. Following all these determinations through Foucault's analysis will allow us to raise the problem of the condition of possibility of an aesthetic judgment with respect to microbes.

A Region Where Things and Words Are Not Separated

Foucault's study in *LNC* traces the transformation of the clinical gaze from the 18th to the 19th century. Foucault focuses on how scientific discourses in this epoch construct their objects of analysis, refer to clinical data, and intersect with or are distinguished from each other. Instead of sorting the discourses out according to a predetermined set of criteria, Foucault observes which terms, classificatory schemes, and manners of speaking come into *light*, and produce all together the *épistémé* of an epoch as a center of gravity of the multiplicity of discursive formations. In this sense, rather than the scientific discourses themselves, Foucault's real object of study is the stratifications of the discursive formations in which things and words, and manners of seeing and saying refer to each other in multiple and nonlinear ways beyond their apparent point of articulation:

... (il faut) s'adresser à cette région où les « choses » et les « mots » ne sont pas encore séparés, là où s'appartiennent encore, au ras du langage, manière de voir et manière de dire. (1963, p. 8)

This does not mean that Foucault doesn't form a corpus that might potentially present the characteristics of a historical formation. But his corpus is constituted more or less arbitrarily, and gradually brings together the discursive elements in which the movements of discursive formations gain a certain *evidence*. Things and words are backstitched in specific manners in their irreparable abyss, but, at the same time, exposed under a layer of apparent exhaustion of signifying regimes in the intelligible syntax of the signified (p. 131). The corpus hides nothing, at least doesn't hold anything in the reservoir; it displays all it can display, and says all it can say:

... c'est que le rapport du visible à l'invisible, nécessaire à tout savoir concret, a changé de structure et fait apparaître sous le regard et dans le langage ce qui était en deçà et au-delà de leur domaine. (Foucault, 1963, p. 9)

The necessary condition of revealing the invisible in each knowledge appears as one of consequences of Foucault's method of grasping things and words in the archive of historical formations. In this regard, when Foucault refers to 17th century philosophers such as Descartes and Malenbranche, it is not to attempt a philosophical elaboration through their arguments, but to search the intersecting points of historical formations as couched in different fields, moving below (*en deçà*) and beyond (*au-delà*) their domains. In the 17th century's philosophical conception of knowledge, seeing predominated other faculties. The operations of "rendering visible" the invisible gave a swarm of disordered lines of sensation a tangible, ordered form, so as to elevate them to the position of knowledge. Scientific experiments and anatomical observations in the case of Descartes, and microscopical observations in the case of Malebranche, testify to the conformity between what is seen and what is described, what is experienced and what is understood³² (p. 11). Accordingly, since the 17th century, the fundamental feature of the constitution of knowledge has been the creation of areas of visibilities and their attachment to mathematical expressions in conformity with proper grammar. In this way, while the eye becomes the privileged organ for the constitution of knowledge, the corpus of scientific and philosophical activities in different fields

³² We have seen a similar perspective in Leibniz. The series might diverge as well as converge in Leibniz. There is no doubt that knowledge functions according to a model of vision. Knowledge appears essentially by the constitution of clear and distinct ideas but with Leibniz, they represent only one layer and moment of reality's complexity that comes into surface. Furthermore, real conditioning of knowledge begins with distinct-obscure ideas that would ramify into different fields, preceding the operations of elucidation.

comes together in the operations of clearing and distinguishing ideas in the structure of the classical *épistémé*:

L'œil devient le dépositaire et la source de la clarté ; il a pouvoir de faire venir au jour une vérité qu'il ne reçoit que dans la mesure où il lui a donné le jour ; en s'ouvrant, il ouvre le vrai d'une ouverture première : flexion qui marque, à partir du monde de la clarté classique, le passage des. « Lumières » ou XIXe siècle. (Foucault, 1963, p. 10)

One of the fields that classical *épistémé* and its transformation manifest in its proper conditions is the clinic, and the study of disease as the space to integrate the observations in several fields. Clinic brings with it how microbe is defined, and what “being-microbe” means, depending on how a disease is defined, according to which classificatory schemes, and to which ends they are channeled. This does not mean that signficatory regimes of disease are completely fused with that of being-microbe. Rather, they enter into various relationships with each other to join together with many other factors and fields. Thus, the birth of the clinic, its organization, and corresponding changes in the modes of relationship encompassed by it, also bring about changes in the being-microbe, whose originary semantic locus is defined by scientific activity, and spreads certain characteristics of being-microbe into the wider social plane.

A Conception of Disease Based on Species

What Foucault finds in the study of disease with the birth of the clinic is a structure that provides conformity between visible (*le visible*) and statable (*l'énonçable*) in their interlacing: “*La structure commune qui découpe et articule ce qui se voit et ce qui se dit*” (p. 18). How does this structure function so as to bring elements of the visible and statable, heterogeneous in their own sphere, but rendered isomorphic by the operations of the clinical organization? Foucault brings together a certain corpus of the 18th century in order to observe how statements (*l'énoncé*) trace a curve through points of consolidation of the areas that have been put into evidence by the presuppositions of the scientific discourses of the epoch with respect to examined diseases. Conversely, visibilities give rise to and provide legitimacy to certain statements that asymptotically trace another curve, presupposing the examined body's transparency. The contiguity of these two

lines, visibilities and stabilities, is realized by reference to the available scientific propositions' classificatory schemes in conjunction with the clinic's preliminary organizational elements:

Avant d'être prise dans l'épaisseur du corps, la maladie reçoit une organisation hiérarchisée en familles, genres et espèces. Apparemment, il ne s'agit que d'un « tableau » permettant de rendre sensible à l'apprentissage et à la mémoire le domaine foisonnant des maladies. (Foucault, 1963, p. 21)

The way in which living beings are classified and hierarchized into families, kinds, and species finds its expression in the classification, identification, and definition of diseases. Body is referenced as projected by this hierarchical structure where inferior and superior elements refer to each other in concert, in order to turn visibilities and stabilities back into each other. In this way, the 18th century conception of disease is essentially defined by a hierarchized organization dispersing symptoms and signs into sub-units, bringing about the *tableau vivant* of the epoch. At first sight, the use of the term *tableau vivant* might seem like a metaphor for explaining Foucault's essential task of addressing the region where things and words are not separated, but it specifically designates the isomorphic expression in writing space through the interlacements between things and words in the epoch where they are addressed in the corpus. In Foucault's original method of archeology, *tableaux* play a crucial role. He presents detailed descriptions of painting, drawing the tableau of the tableaux in his writing. For example, in *Les mots et les choses* (1966), he situates *Las Maninas* of Velasques as the crystallisation of certain features of transformation for the classical *épistémé*, pointing some intersecting lines with three emerging fields of scientific investigation (linguistics, political economy and biology), which gain certain evidence by surpassing an epistemological threshold³³.

The techniques and methods constituting scientific discourses provide an important repertory for ensuring the continuity between visibilities and stabilities, helping to increase the lucidity of the clinical gaze. In the 18th century, natural history assumed this role:

³³ Even when Foucault, in his studies about the power relations, abandons the use of the term for specific reasons, he mobilizes the same technique to experiment in his own writing in order to describe the complex interrelations between visibilities and stabilities. The horrific torture scenes in *Surveiller et Punir* can be taken as an example.

La clinique demande autant au regard que l'histoire naturelle. Autant et jusqu'à un certain point la même chose : voir, isoler des traits, reconnaître ceux qui sont identiques et ceux qui sont différents, les regrouper, les classer par espèces ou familles. (Foucault, 1963, p. 129)

With every attempt at classifying living beings through observable resemblances and differences, a certain definition of living beings that has predominated philosophy and scientific discourses since antiquity would acquire a more and more methodological consistency. The clinics would take over this approach and step in the direction of its institutionalization. The boundaries between species, kinds and families in the living world as well as the species of diseases would increasingly sharpen, signs and symptoms would more directly relate to diagnosis, and then to methods of treatment and prevention. Therefore, on the one hand, while the transition from state of health to state of disease assumes a degradation founded on the characters of the classified diseases, an absolute identity would be assumed between observed phenomena during an illness and explanatory schemes on the other. This is the clinic's founding act or postulate that will have difficulty sustaining itself at the end of the 18th century when confronted with the complexity of events and cases. What will come to define the clinic would essentially be its precarity rather than its presuppositions pertaining to conformity: "*La clinique est un équilibre précaire, car elle repose sur 'un formidable postulat' ... à savoir que tout le visible est énonçable et qu'il est tout entier visible parce que tout entier énonçable*" (p. 116).

Interestingly, Foucault sees a similar effect in the example of calligrams in *Ceci n'est pas une pipe*. Here, the visual form of writing and the written form of the visual reciprocally presuppose each other, exchanging their specific patterns (Foucault & Magritte, 1973, pp. 16-17). But René Magritte's painting *Ceci n'est pas une pipe*, we are reminded that we can't trust what we see and write. Despite our conditioning to see and say things in certain ways, we are always betrayed by them (p. 23) (the milieu of the pipe is unfaithful!). In the same way, what makes the fundamental postulate of the clinic "astounding" (*formidable*), is not only how it presupposes the conformity between the visible and storable, but also the possibilities it mobilizes, the institutions it organizes, and the impasses it leads, until arriving at its total dysfunctioning:

Or l'armature logique de la pensée clinique n'est pas en cohérence absolue avec ce postulat et la réversibilité sans résidu du visible dans l'énonçable reste dans la clinique une exigence et une limite plutôt qu'un principe originaire. La descriptibilité totale est un

horizon présent et reculé, c'est le rêve d'une pensée, beaucoup plus qu'une structure conceptuelle de base. (Foucault, 1963, p. 117)

Even though the clinic's "astounding postulate" shaped certain instruments and techniques in advance to put into practice, it basically functioned as the requirement and horizon to which all hierarchical organization would cling from its smallest units to more general levels. In this relatively preliminary stage of the clinic's constitution, each case is reconstructed according to this requirement which expands the fundamental postulate in its horizon and meets with the practices, hitting each time certain unexpected factors leaking from the bolts of the organization. "*La descriptibilité totale*", meaning that the *tableaux vivants* of diseases find their corresponding expressions in the codification of a conceptual structure, as imbricated in a syntax of the disease's grammar. However, this remains a "dream" of the sciences; the horizon of its presuppositions retreats so as to displace the applicability of principles.

In the very surface of the clinic, a gap is opened between presuppositions and principles; the one continues to form practices while corroding principles, the other constantly loses its basis while resituating presuppositions. The dream is precisely this: the negation of this irreparability, a *belief* in the unshakable order of the hierarchical organization of the body. In its alternating states of health and disease, the dream is that the body always holds a certain perfectly functioning mechanism as an ultimate "natural" state to be returned to. A dream, however, is not simply a reference to the unrealizability of certain premises but is real in its own terms. In the following epochs, this dream will condition an awakening in particular ways (maybe with their own dreams), and, more generally, have important consequences in the organization of the social field. A dream is always a mixture of a state of awakening and somnolence. Even though the pressure and resistance of experience and knowledge are reduced to a minimum, barely perceptible elements still enter into a dream. By stretching the confined and isolated resuscitations of the forms imposed by the dream, they exercise the twists by the insomnia of thinking, poised for multiple deformations³⁴.

³⁴ Maybe the possibility and origin of political resistance in Foucault's thinking stems from the reversal of dreams. Such a conception of dream conjures Deleuze's analysis of the dream in an article in *Critique et Clinique* (1993, *Éditions de Minuit*, pp. 158-170), *Pour en finir avec le jugement*, about the possibility and actualization of judgement. The texture of the dream strangely resembles the organization of judgement

That the dream was slipping was already felt in the very framework of the classical episteme and rebounded in the characterisation of the study of disease in the 17th and 18th century based on families, species, and kinds. Today, this model doesn't work as simply anymore, if it ever did:

À la pure essence nosologique, que fixe et épuise sans résidu sa place dans l'ordre des espèces, le malade ajoute, comme autant de perturbations, ses dispositions, son âge, son mode de vie et toute une série d'événements qui, par rapport au noyau essentiel, font figure d'accidents. (Foucault, 1963, pp. 26-27)

The first reason why the medicine of species inclined towards another modelization is that the nosological conception of disease based on hierarchical classification of things was obliged to take into consideration the patient's own account of their lived experience. At one point, the recounting of personal experience produced much richer information than the scenario proposed by existing knowledge regimes and its corresponding organization for treatment. The reconstruction of a disease through existing knowledge regimes strives to rearrange the application of knowledge according to the course of a disease. The addressees of this transformation (practitioners, doctors, theorists, or philosophers) necessarily experiment with the singularity of the cases by improvising solutions at different levels in order to respond to the disease's changing and yet unconceived aspects: *“Dans cet espace corporel où elle circule librement, la maladie subit métastases et*

and this proximity reveals the conditions in which judgement actualizes itself in forms and structures: *“Le monde du jugement s'installe comme dans un rêve. C'est le rêve les jugements s'élancent comme dans le vide, sans rencontrer la résistance d'un milieu qui les soumettrait aux exigences de la connaissance et de l'expérience; c'est pourquoi la question du jugement est d'abord celle de savoir si l'on rêve”* (p. 162). We don't exactly know if we are in a dream. What's worse, we might be in someone else's dream, trapped or dominated by a dream which is not ours. It is important note that Deleuze's understanding of dream is highly influenced by Bergson's article on dream in *L'énergie spirituelle* (1990 [1919], *Press universitaire de France*, pp. 85-110), *Rêve*. Bergson approaches dreams not with respect to judgement but to the functioning of memory and the bifurcation of possible paths of action. Now, the dream is no longer the launching pad of judgement in an absolute state of schematization of form and content but rather an instance which exhibits that any recollection of memory wouldn't be effective without a margin of hallucination. *“Ainsi, à l'état de veille, la connaissance qui nous prenons d'un objet implique une opération analogue à celle qui s'accomplit en rêve. Nous n'apercevons de la chose que son ébauche; celle-ci lance un appel au souvenir de la chose complète; et le souvenir complet, don't notre esprit n'avait pas conscience, qui nous restait en tout cas intérieur comme une simple pensée, profite de l'occasion pour s'élaner dehors. C'est cette espèce d'hallucination, insérée dans un cadre réel, qui nous nous donnons quand nous voyons la chose”* (p. 99).

métamorphoses. Le déplacement la remodèle en partie” (p. 29). The second reason is that these improvised solutions required more extensive coordination, which will in the end make health a “national task”:

Une expérience médicale diluée dans l'espace libre d'une société qu'organise la seule figure de la famille ne suppose-t-elle pas l'appui de la société entière ? N'implique-t-elle pas, par l'attention singulière qu'elle porte à l'individu, une vigilance généralisée dont l'extension coïncide avec le groupe en son ensemble? Il faudrait concevoir une médecine suffisamment liée à l'Etat pour qu'elle puisse, de concert avec lui, pratiquer une politique constante, générale, mais différenciée, de l'assistance, la médecine devient tâche nationale.... (Foucault, 1963, pp. 41-42)

Another type of pressure on the classical episteme came from the need to organize the dispersed data generated through different areas and mobilize it for the diagnosis, treatment, and prevention of disease. Since the end of the 18th century, the State has increasingly played the role of the one integrating divergent lines of investigation of different areas in order to formalize and therefore institutionalize solutions in a more systematic way. The State embodies several dimensions in order to regulate them from a certain perspective as a rallying point, while at the same time relaunching those dimensions into the abyss between words and things, visibilities and stabilities.

Disease as Event: Towards a Pathological Anatomy

By the end of the 18th century, the model of the clinic, and in that respect, of disease based on hierarchical models of organization no longer functioned at both conceptual and practical level. To fill the gap between visibilities and stabilities, what the clinical sees and says, reference to resources that hierarchically organize families, species, and kinds will be interrupted each time. This will gradually lead to the conceptual, organizational, and institutional transformation of the clinical gaze under a new modality:

Mais le regard médical s'organise, en outre, sur un mode nouveau. D'abord, il n'est plus simplement le regard de n'importe quel observateur, mais celui d'un médecin supporté et justifié par une institution, celui d'un médecin qui a pouvoir de décision et d'intervention (Foucault, 1963, p. 130).

To mobilize the hierarchical model, it was enough to be present in and engage with the field to a minimum degree as an observer. The decision of the clinician was preceded by a common structure interlacing the visibility and statability in conformity with hierarchical organization. The role of the practitioner was to check and recalibrate the conformity of necessary stages, and in contrary cases, to improvise solutions by appealing to the model's "logical armature". However, reconstitution of patient's experience by virtue of collected data dispersed into different areas of knowledge, capable of detecting the signs in their own ways, requires presupposing complex interrelations between a series of events in the course of a disease. As a consequence, the clinical gaze came to the surface through intricate interactions between scientific discourses since it was directly attached to institutional availabilities. In this new "*tableau*", while the clinician appears as decision-maker in the heat of the moment, in their presence all coordination of institutional organization pulsates. Therefore, a disease, rather than being a pale image of the interrelations of divergent lines that have been indiscriminately put in temporary stitches ripping from all parts, consists of a convergent network in which a multiplicity of events passes onto each other in their internal development. Here, the clinical gaze will find its real character in this logic of events: "*La médecine ne se donne plus à voir le vrai essentiel sous l'individualité sensible ; elle est devant la tâche de percevoir, et à l'infini, les événements d'un domaine ouvert. C'est cela la clinique*" (p. 140).

This, at the same time, can be said to be the dissolution process of the model of disease that functions by reference to essences. The tableau of the prior model was making sensible the individuality of cases for learning and memory in accordance with hierarchical organization, and, in this way, a certain historicity predominated the geographical atlas of the body. Now, the constitution of one single case required the consideration of a series of events through the collaboration of diverse areas, sensitive to each other's way of determining symptoms and benefiting from the institutional organization interconnecting them. Therefore, medicine could not confine itself to a mere historical appropriation but needed to perceive the singularity of the event: "*Par sa multiplicité, la série devient porteuse d'un indice de convergence*" (p. 54). An individual fact now ceased to be the corresponding image of an assigned unit in the hierarchical organization. Instead, it gradually appeared by mutual adjustment of diverse fields, enveloping a set of infinite separate events. The only manageable way of administering the gradually increasing complexity

of events was to put the newly arising tools of this epoch into practice. Statistics will assume the role of perception, making the necessary trimming and selection in the field:

Toutes indiquent que la visibilité du champ médical prend une structure statistique et que la médecine se donne pour champ perceptif non plus un jardin d'espèces, mais un domaine d'événements. (Foucault, 1963, p. 147)

In this way, we pass from a medicine based on species to a medicine based on events, which will give visibilities a character of statistics concerning the clinic's perceptive field. While the former constitutes the clinical gaze that gives rise to a certain hierarchical order of stabilities through progressive transmissions of the individual sensibility, the latter meanders in the field of events so as to attune the relevant parts of diverse areas according to the singular seriality of events. The layers of visibilities and stabilities dislodge only to twist together again in different conditions where chances and risks are distributed in an open field: "*Enfin, c'est un regard qui ne se contente pas de constater ce qui évidemment se donne à voir ; il doit permettre de dessiner les chances et les risques ; il est calculateur*" (p. 147). The interconnection between visibilities and stabilities is reposed, but this time, by holding their heterogenous elements in place, through a sign (*indice*) of convergence. This also brings a change in the mode of clinic's writing: from the grammar of syntax functioning by returning to the conformal end points to the probabilistic calculator logic of writing. All systems would be re-coordinated according to this new logic:

Ce n'est donc pas la conception de la maladie qui a d'abord changé, puis la manière de la reconnaître ; ce n'est pas non plus le système signalétique qui a été modifié puis la théorie ; mais tout un ensemble et plus profondément le rapport de la maladie à ce regard auquel elle s'offre et qu'en même temps elle constitue. (Foucault, 1963, p. 130)

Disparate elements become sensitive to each other, are integrated under a mode of open system of signing, and in each cycle, rearranged according to the singularity of cases. This is the main reason why in this new organization the visible and stable are posited as heterogenous terms, and their interweaving appears only as an effectuation of interruptions traversing the whole process.

What is interesting in Foucault's examination of the corpus of the pathological anatomy is that the transformation of the clinical gaze brings repercussions at a global level, both foreshadowing and echoing social, political, and philosophical transformations. Even though Foucault keeps priority of visibilities over statements, with the transformation of the clinical gaze

their isomorphism is accentuated in the sense that they maintain their autonomies but relate to each other by the absorbing medium of the abyss separating them. Hearing the sign systems of the not-yet visible is interrupted by silence. The perceived immediacy of the spectacle field of disease disrupts the operability of the mutual referencing of relevant theoretical approaches (“evidences”), which would play a positive role in the re-attunement of disparate systemic elements with each other³⁵.

Now, in this new mode, stabilities reside exactly at this moment of disruption, giving the real “thickness” of the body in the articulation with visibilities, which will serve as the ground for anatomical pathology:

L'observateur ... lit la nature, celui qui fait l'expérience l'interroge. »... Le regard qui observe ne manifeste ses vertus que dans un double silence : celui, relatif, des théories, des imaginations et de tout ce qui fait obstacle à l'immédiat sensible ; et celui, absolu, de tout langage qui serait antérieur à celui du visible. Sur l'épaisseur de ce double silence, les choses vues peuvent enfin être entendues, et entendues par le seul fait qu'elles sont vues. (Foucault, 1963, pp. 154-55)

In this new model, visibilities and stabilities are rearticulated in each other, this time in their logic of coming together, by making its founding presupposition the proposition that the abyssal fissure forking them into infinite distance can never be reparable. This new regime manifests itself in the mode of the clinician's presence as an observer in an open field of spectacle of events in the bifurcation of the relative silence and absolute silence. Only when this double silence immanently takes over the process in the constitution of the clinical gaze, in other words, when they come

³⁵ For example, with Corvisart, Foucault realizes that the priority of vision over statement in classical episteme is distributed to disparate instances of pathological anatomy through the heterogeneity of elements. Disruption in the articulation of system assumes a fracture in the stabilities' consecution of visibilities that manifest itself as a 'silencing' of relevant theoretical approaches: “*Dans la thématique du clinicien, la pureté du regard est liée à un certain silence qui permet d'écouter. Les discours bavards des systèmes doivent s'interrompre : « Toute théorie se tait ou s'évanouit toujours au lit du malade » (Corvisart)*” (pp. 153-154). The heard language of the perceived spectacle of disease comes in a paradoxical form. Harkening to available signs of systems knitted by moments of silence does the chattering of theories come to a halt, at the same time fermenting the perceptible, yet untranslated, signs of system that would become the conditioning factors for next iterations.

together in a region where things and words are not yet separated in the silence of words and in the invisibility of things, it becomes possible to see things as they are heard and to hear them as they are seen. The clinical gaze is identified through all field effects in the operational structuring whose continuity depends upon the necessary cuts in the process of clinical examination. At this stage of the reorganization of clinical gaze in the pathological anatomy, Foucault observes this conceptual movement of double silence in Xavier Bichat's concept of "tissue".

Thickness of Body, Illuminating Gaze of Death

French anatomist and pathologist Bichat is known by his ground-breaking observations on human anatomy and classification of pathologies by virtue of his autopsy techniques. The autopsy, for Bichat, was not only an anatomical tool but also an analytical instrument serving as the basis for the lucidity of knowledge necessary for the culmination of anatomical observations: "*Ouvrez quelques cadavres : vous verrez aussitôt disparaître l'obscurité que la seule observation n'avait pu dissiper*". For Foucault, Bichat's attempt to open the dead human body and understand the phenomena of disease, and accordingly, health was a crucial moment in the reorganization of the clinical gaze. The inevitability of death and its immanence to life have been themes since antiquity. However, until Bichat, when it came to thinking about the intricate relationship between life and death, death appeared only as an absolute end point endowed with a sort of unthinkability, left without any conceivable model. In this way, the brightness of light and darkness of death were separated clearly and distinctly so as to never transgress the boundaries of each other. Whereas with Bichat, the regions of life and death are never stable; they contaminate each other in different degrees according to the singularity of autopsied body: "*La nuit vivante se dissipe à la clarté de la mort*" (Foucault, 1963, p. 206). For Bichat, it is impossible to understand life without the direct implication of death, and there is no single life phenomenon that doesn't implicate death. As Foucault put it, "*à partir du cadavre, on la [la mort] perçoit paradoxalement vivre*" (p. 207). To realize this kind of conceptual transformation, it was necessary for Bichat to shift the focus of the unit of analysis, still characterized by the logic of species, and the predominance of the organs over other units.

Before Bichat, organs were conceived as the central point of gathering for life phenomena, dictating how subunits would behave under particular conditions and fulfill tasks according to the needs of organs. But when Bichat opened the human corpse, he observed that organs were only one layer among others, and the “real” thickness of the body in which complex functions were realized was situated in intermediary units. Bichat’s complex of tissue was a simplification of the complex functioning of organs. On the other hand, it was also a real passage to the deeper layers of the body as rolled out in the observable superficial sections of tissue. Now, it was understood that it was not the organs that functioned as the central unit of operation which organized all other sub-units and provided communication between organs and systems. Rather, it was tissue that brought together multiple diverse pathways of organs, cross-sectionally bridging life and death phenomena. Bichat arrived at his conception of tissue by the autopsy techniques he developed, in which anatomical knowledge and pathological anatomy mutually embraced each other. In a way, similar to Canguilhem’s analysis of normal and pathological (in which Bichat was a crucial figure), understanding the dead body through the aid of autopsy techniques was the very condition of understanding how pathologies emerged and invaded the body until the total halting of vital functions, which meant death: “*L’anatomie n’a pu devenir pathologique que dans la mesure où la pathologique anatomise spontanément*”.

In this way, with Bichat, we find that the vertical organization of the body is articulated with the horizontal organization of the depths of body, coming together in the surface area of tissues. According to Foucault, the medical gaze, starting with Bichat’s anatomical pathology, would then be organized on this principle of cross-referencing the vertical and horizontal organizations of the body. The medical gaze will go along with the determination of symptoms according to the regimes of signs of different fields becoming more sensitive to each other in a logic of events as well as concerning institutional regulations. In this field of mutual sensitivities and imbrications, the anatomoclinical gaze will finally constitute a voluminosity altogether:

Il faut donc que le regard médical parcoure un chemin qui ne lui avait pas été jusqu’alors ouvert : voie verticale allant de la surface symptomatique à la superficie tissulaire, voie en profondeur qui s’enfonce du manifeste vers le caché, voie qu’il faut parcourir dans les deux sens et continûment si on veut, d’un terme à l’autre, définir le réseau des nécessités essentielles. Le regard médical dont nous avons vu qu’il se posait sur les plages à deux dimensions des tissus et des symptômes devra, pour les ajuster, se déplacer lui-même le

long d'une troisième dimension. Ainsi sera défini le volume anatomoclinique. (Foucault, 1963, p. 191)

This path of analysis was not always available. The clinical gaze was always moving in one direction in compliance with hierarchical organization, and points of suspension that wouldn't obey this progress, tolerated by palliative solutions without acquiring real consistency in themselves. What was hidden was presupposed as well as how it could be revealed. Now, with Bichat, the hidden and manifest, went in both directions, and the invisible and visible changed character from one case to another. Disease analysis no longer took a tabulated form, presenting a certain *tableau* of the classical episteme, making write itself in the statements. Disease itself became the analysis since the interiority of disease could no longer be separated from the supposed interiority of a clinician's consciousness. In the geographical atlas of the body, the clinician now situated together with all other contributing factors, including scientific statements and classifications, in the same continuum of the anatomical and pathological (pp. 183-184), and throwing them into an open space of exteriorities. Symptom and tissue entered a zone of indistinction. What was found in symptoms revealed itself on the surface of the tissues, explaining their functioning under "normal" conditions, and the tissues' anatomy was already tensed towards the manifestation of symptoms in a mode of preparation for the potential diseases. A disease was no longer characterized by its distance from the state of health, presupposed by the mechanical functioning of the body. Now, it was dispersed over all bodily interactions and adjustments, manifesting itself even in the supposedly healthiest region:

La maladie n'est plus un faisceau de caractères disséminés ici et là à la surface du corps et liés entre eux par des concomitances et des successions statistiquement observables ; elle est un ensemble de formes et de déformations, de figures, d'accidents, d'éléments déplacés, détruites ou modifiés qui s'enchaînent les uns aux autres selon une géographie qu'on peut suivre pas à pas. Ce n'est plus une espèce pathologique s'insérant dans le corps, là où c'est possible ; c'est le corps lui-même devenant malade. (Foucault, 1963, pp. 183-184)

It was no longer enough to determine a species of disease and follow its repercussions until the most hidden corner of the body through statistical aggregates. With the concept of tissue, disease could no longer be defined by its observable form, but by all sorts of contingent movements giving rise to "forms and deformations, figures, accidents, displaced, destroyed or modified elements", all inherent to the geography of the body. Pathology was no longer understood as beginning with

a determined symptom associated with a species of disease. Contingent elements were so diversely scattered throughout the body that any region could be an area of incubation for a pathological variant, or simply in a mode of change in the suspension of states so as to proceed with normal mechanisms. As such, normal and pathological ceased to even connote average states, which characterized the ultimate points of the analysis as the basis of the final decision of health or disease, but they are held in the smallest perceivable gap where the death makes its ingress. Along these lines, the status of death changed the whole panorama of the clinical gaze. Now, death was no longer an unthinkable, absolute end point of life without a model but imminently and immanently everywhere. One of the fundamental consequences of Bichat's anatomical pathology might seem hackneyed but comes into view in the anatomical surface of the body: there is no life without death and there is no death without life. Rather than being the sudden disappearance of vital functions, the phenomena of death operate as an analytical eye, immanently surveying vital mechanisms. As much as the tissue networks that are the gateways of the vital connections accommodate the partial and gradual deaths (*“la forme de morts en détail, morts partielles, progressives et si lentes à s'achever par-delà la mort même”* (p. 203)), they also allow and integrate the passage of different regimes of signs, which keep the organism in a certain state of stability:

La mort est donc multiple et dispersée dans le temps : elle n'est pas ce point absolu et privilégié, à partir duquel les temps s'arrêtent pour se renverser, elle a comme la maladie elle-même une présence fourmillante que l'analyse peut répartir dans le temps et l'espace ; peu à peu, ici ou là, chacun des nœuds vient à se rompre, jusqu'à ce que cesse la vie organique, au moins dans ses formes majeures... (Foucault, 1963, p. 200)

The proximity of death and disease arises from their omnipresence in each vital phenomenon. As a result, the anatomic plane is composed of heterogenous spatial sections and temporal (rhythmic) patterns. The entanglement of life and death traces knots of speed and viscosity to provide an operational integration for the concerning region of the body. From this perspective, autopsy can be said to accompany the processes of breaking off (*se rompre*) the knots, until the retrospective constitution of the processes of impelling vital functions that form an active degree zero of death. Death enables the clinical gaze to situate itself in the singularity of the case (autoproduction of the clinical gaze). Far from being a point of obscurity sinking into an absolute

unintelligibility and unthinkability, here, death becomes a self-analysis of life (“*grand oeil blanc qui dénoue la vie*”), running from one processual endpoint to another.

For Foucault, the importance of Bichat’s analysis is not only that it constitutes a crucial moment in the transformation of the clinical gaze and bestows it with its modern origin. Irreducibly to this theme, Bichat’s analysis provides the basis for thinking death at the margin of its unthinkability; a crucial theme in the thinking from (of) outside found in Foucault’s elaboration of Maurice Blanchot’s concept of outside (*le dehors*). Even in this quite early study of the clinical gaze, it seems that Bichat’s notion of tissue presents some intriguing points of entry to this challenging problem of outside beyond the tasks at hand. What is interesting in this account is that the presentation of death’s immanence and its operativity in vital processes liberates a surplus energy emerging from disease signs (pp. 216-217). At this moment, vitalism turns into a strange kind of mortalism: “*Le vitalisme apparaît sur fond de ce « mortalisme »*” (p. 204). The foundation of life becomes deviation in the gap between pathological phenomena and physiological processes, which plays the role of constantly producing surplus energies and their circulation in the body (p. 217).

* * *

In this way, we have closed a large circle from the conceptualisation of microbes as pathogenic beings in scientific discourses to the accommodation of life and death phenomena in tissues. Together with Canguilhem, we have seen that even when the pathogenic conceptualisation of microbe was linked to scientific categories and thus became part of the disease context, it historically involved an aspect of adventure and value in the life conditions of microbe through the concept of milieu. With the rise of the modern clinical gaze, different scientific fields, their conceptual devices and data, as well as their organization at institutional level had become more and more sensitized to each other. All system responded to the corresponding changes in subfields. Accordingly, being-microbe gained various dimensions depending on the resonances between fields. In the concept of tissue emerging in concert with the transformation of the clinics towards the understanding of disease as event, being-microbe joined the problematic surface where death-life phenomena play together. In this surface, being-microbe becomes an event on its own with

epidemics and ceases to be a factor among other factors. Epidemics will become the culminating point of all fields' cross-sensitivity.

Epidemics emerge with such power that no known settled formation of the world could manage to contain it. Conversely, efforts at controlling and subsuming epidemics to existing mechanisms where their effects could be processed in certain ways, would transmute the diagram that operates their resonations across scales to produce certain effects. This is also the point at which the question "what can a microbe do" arises. In epidemics, microbes they reach their highest power, in the ingression of an outside, devastating, yet creative.

In the Trajectories of Epidemics

It would be remiss to say epidemics is one of the central themes of analysis in *LNC* or in *Surveiller et punir*. Rather, Foucault touches upon epidemics only in passing, as an extension of another analysis or as an example. In *LNC*, he gives the example of epidemics in relation to the impossibility of considering disease phenomenon in isolation from other aspects of the clinical gaze. In *Surveiller et Punir*, while explaining shifts in diagrams of power, Foucault compares two kinds of epidemics in Europe in the 18th century as the preparatory analysis for the implementation of the image of panopticon as the pivotal figure of a new type of power relations with the rise of disciplinary societies. At the end of the 17th and to the 18th century, leprosy and plague would represent the reorganization of power strategies, culminating into two different models, with all disappearing, transmitted and newly emerging principles, effects, and tools.

Diversely, some aspects of the epidemic analysis in *LNC* also make sense for *Surveiller et punir*. In the next section, I will follow both the continuities and discontinuities between Foucault's two epidemic analysis to, in the end, demonstrate how epidemic has become a problematic field in its own right. If the zero point of being-microbe is the known microbe properties science has attached to categories, I will argue that the maximum point is the epidemic, which comes with unexpectedness and uncontrollability.

* * *

The analysis of epidemics in *LNC* specifically takes place to exhibit the global character of disease that cannot be abstracted only from the conditions surrounding it. The relational aspect of disease which connects it to other dimensions of the clinical gaze becomes manifest in the case of epidemics: “*Toute constitution n’est pas épidémie ; mais l’épidémie est une constitution ou grain plus serré, aux phénomènes plus constant et plus homogènes*” (1963, p. 44). In Foucault’s reading, when the same phenomena of disease gain a certain constancy of repetition, then the pattern can be said to be considered as sign of epidemic. In other words, the difference is not of nature, but of degree between cases of disease and of epidemic:

Il n’y a donc pas de différence de nature ou d’espèce entre une maladie individuelle et un phénomène épidémique ; il suffit qu’une affection sporadique se reproduise un certain nombre de fois et simultanément pour qu’il y ait épidémie. (Foucault, 1963, p. 44)

Each single case of disease has the potential danger of turning into an epidemic. Nevertheless, epidemics require a much broader mobilisation and higher levels of scientific, conceptual, political and institutional integration and coordination. Information flowing from diverse areas progressively becomes more inclined for integration in terms of identifying the characteristics of epidemic, and taking the preventive measures that will require a higher level of coordination between units. Because the most fundamental characteristic of an epidemic is its unexpected emergence like a flashing of thunder. It is essentially defined through an excessivity not capturable by existing categorical schemes. The uncontrollability found at the origin of all diseases, that mainly manifests itself mainly in a patient’s unidentifiable symptoms or inadequate treatment methods gains a collective dimension with epidemics:

Phénomène collectif, elle exige un regard multiple ; processus unique, il faut la décrire sur ce qu’elle a de singulier, d’accidentel, d’inattendu... elle ne trouve son volume propre que dans le recoupement des perspectives, dans une information répétée et rectifiée, qui finalement cerne, là où les regards se croisent, le noyau individuel et unique des phénomènes collectifs. (Foucault, 1963, pp. 47)

The exigence of a ‘multiple gaze’ will be the primary motor of the transformation of clinical gaze whether or not an epidemic is in question. But with epidemics, the singularity of the health-disease continuum reaches its peak and hits the earth with its unexpectedness concentrating multiple events at its core, incarnating existing perspectives, and fermenting new ones. Both singular and collective, an epidemic retrospectively activates certain aspects of fields that remain invisible in

their ‘normal’ functioning, anticipatively presenting them with a mass of data that will bring in them new perspectives for future events.

The clinical gaze, carried away in the same movement that cuts through different fields, is directly connected to the social field. The social field is affected by clinical organization and in turn affects it through discursive, biological, political, institutional flows of heterogeneous elements in their materiality. In this way, the clinical gaze begins to exceed the boundaries delineated by hierarchical organization, imposing a pre-given classificatory scheme in the treatment of diseases. In its deeper integration with the social field, the clinical gaze meets with new possibilities and confronts new constraints, turning into a complex structure through which various layers and levels intermingle and interact with each other.

Up to a certain point, an analysis of epidemics follows a parallel course with the analysis of the transformation of clinical gaze. After showing the increasing necessity of integrating different fields in capturing the singularity of cases, Foucault leaves the epidemic analysis aside and to concentrate on the conceptual knots inherent to the transformation of the clinical gaze. What remains of this analysis, however, is that epidemics paradoxically represent the singular and collective character of cases of disease which are the very object of the clinical gaze. In the next section, I take a look at a dense passage in *Surveiller et punir* about two kinds of epidemics and the problematization of corresponding power diagrams.

Transformation of Power Diagrams and the Unfolding of an Outside

In the third chapter of *Surveiller et punir* under the title *Panoptisme* Foucault makes his widely recognized proposition of the prison model of panopticon as the prominent image of the diagram of modern power formations. This diagram is the basis of disciplinary societies, organized around a different logic from the previous diagram of the societies of sovereignty. But interestingly, before elaborating on his proposition, Foucault analyzes two cases of epidemics in Europe. Leprosy and plague display two different but somehow related models of coping with epidemics, which prepare the processes leading to the emergence of the power diagram of disciplinary societies. Foucault examines Vincennes military archives which detail the measures

to contain epidemics. His epidemic analysis ends in five pages and has the flavour of a novel's descriptive scenes; rather than certifying the historical milestones, it offers important cues for explaining the transitions and transmissions, continuities and discontinuities between scientific, social, and political fields during epidemics.

According to the model of leprosy corresponding to the middle of the 16th century and extending into the 17th, the boundary between sick and healthy was absolutely delineated. In this model, methods for dealing with epidemics were based on rituals of exclusion: you are either on the inside or banished. For Foucault, this logic of exclusion is the cutting edge of power strategies. However, the real strategization of power relations will arrive in the form of total governmentality of society by reference to, and on the grounds of fighting against the epidemic. Coded as an absolute evil with respect to the imminence of death, the epidemic will begin to take its definite form in the case of plague. From the model of leprosy to that of plague, reorganization of society as well as ways for dealing with the epidemic will change character and pave the way for much more meticulous exercises and techniques.

The most striking feature of social mobilisation against the plague was that the measures and regulations imposed entered the most intimate aspects of daily life. The main element creating this situation was that the regions containing risk of contamination were kept in quarantine, creating strict spatial partitioning. The exercise of quarantine enabled the State to control and watch the slightest action that might turn into a sign of contamination. For this task, a lot of personnel needed to be mobilized. Intendants, syndics, and guards watched the streets and houses, registering the course of daily life in its slightest details. This led to a system of reporting, from the syndics to intendants, intendants to magistrates or mayor. Another registration system took place at the level of the observation and control of medical data. The physician in charge appointed by the magistrate was responsible for a certain number of people they had to constantly watch, take feedback from, treat medically if needed, focusing on the emergence or the course of pathological. Each inhabitant was called out by a syndic by his name in the registers, gave their oral report, and inspected by a doctor if necessary. The movements registered by institutional staff were accompanied by the movements and measurements pertaining to the field of medicine. The slightest deviation from the presupposed condition of "normality", "*morts, maladies, réclamations, irrégularités*" would get a special attention, and give rise to the implementation of

regulations prepared in advance for these situations. To realize all these tasks, the necessary architectural, institutional, scientific, and political arrangements had to be put into place. For example, houses were reorganized so as to facilitate better communication with syndics without the risk of contagion; new channels were created for ensuring interaction between institutions and scientific knowledge, etc. Therefore, from the seemingly unimportant aspects of daily life to the observation of the first signs of pathological and to the cases of death, a hierarchical structure and organization was put into action, creating a “segmented, immobile, frozen space” that fixed each individual into place. The slightest action deviating from this scheme was punished since it meant the disease, contagion, and hence, death. The hierarchical organization functioned according to a truth regime. Not only did the institutional staff have to tell the truth *as such* so as to *not* allow for any distortion in the collected data in their assigned task, but the inhabitants were also obliged to tell the truth in regards to their situation. Telling the truth was a matter of life and death: “*C’est la grande revue des vivants et morts*” (Foucault, 1975, p. 197).

Partitioning a space goes in hand with creating the regimes of truth where each actor in the field expected to tell the truth from their point of view. The scientific truth determining the conditions how to approach an epidemic resonates in a political truth dispersing the units in their assigned tasks to tell the truth and nothing but truth. Another “truth”, one maybe relatively invisible in comparison to other regimes, functions as the organizing and founding presupposition of epidemics as a field of truth regimes. This truth displays how the creation of all other modes of truth is necessary from the point of view of the epidemic’s exceptionality and necessity of fighting against an “extraordinary evil”. This operates not only as the ultimate reference of legitimation but also conditions other regimes of truth, giving them their basis for settlement. An individual’s relationship with disease and death is mediated by instances of power, as concretized in registration reports, and their assumed decisions, which regimes of truth cross all the time. A diagram is that integrates the small abilities reserved to each actor in its small area, deriving its validity and effectivity from the destructivity of the event, and postponing thinking “differently” to another time by suspending time: the kernel of the disciplinary diagram of modern societies:

Cet espace clos, découpé, surveillé en tous ses points, où les individus sont insérés en une place fixe, où les moindres mouvements sont contrôlés, où tous les événements sont enregistrés, où un travail ininterrompu d’écriture relie le centre et la périphérie, où le pouvoir s’exerce sous partage, selon une figure hiérarchique continue, où chaque individu

est constamment repéré, examiné et distribué entre les vivants, les malades et les morts – tout cela constitue un modèle compact du dispositif disciplinaire. (Foucault, 1975, p. 199)

Without a doubt, the disciplinary schema of the plague aimed at keeping and maintaining the order and unravelling all sorts of confusions, that of disease and death, was functional to a certain extent (*“la peur et la mort effaces les interdits”*). However, all potential confusions would have to be controlled so as to not threaten the functioning of the more or less mechanical order. Any possible mixture of elements and events that might disrupt the homogeneity of the organization with respect to the regime of truth, set off alarm bells for units in the disciplinary diagram. They induce the units to decompose the situation so as to reduce it to the purified categories that are sustained by the mechanisms in operation. The disciplinary diagram functions by separations, its analysis by the implemented techniques and the predetermined rules, yielding outcomes for restarting the diagram. Power is omnipresently and omnisciently formed, penetrating each aspect of life by virtue of surveillance and control. Its diagram is even more intensified by the ramifications in regards of the delineation of the plague-stricken and non-plague-stricken situations (p. 200), infinitely detailed by the implementation of new procedures, until arriving at the final determination of the individual (sick or no sick; how so?). The individual is not simply the totality of the determinations functioning on it; on the contrary, its identity only appears as an effect (in the optical sense), constituted as the product of the power relations exercising over bodies, desires, forces, and abilities.

Even though an order is defined by its perfection, what gives its real character is the elements, hindering it from maintaining itself as such, in other words, that which remains exterior to it. In the case of leprosy, this form of exteriority could not acquire its visible form as such, since its logic of exclusion did not allow to detect and distinguish the impressions of the exterior movements in the unidimensional form of the spatial configuration of the inside that recognized nothing but its representational correlates or its opposite. Only one sign was enough to realize the categorical separation, and once realized, it contended with reproducing the same scheme once and for all. With the plague, this logic of exclusion didn't totally disappear. However, until arriving at the moment of exclusion, it goes through multiple stages, assuming a specific categorical separation at each step, separated from, yet connected to, other threads through the common presuppositions cutting across them. In this way, the organization of the whole disciplinary diagram becomes sensitive to the deviations of the categorical cuts with a focus on the

pathological, culminated in the actions to be taken. The system opens and expands towards two sides at the same time. On the one side, it vertically determines the points of accumulation of events in their relationships with each other; on the other, it horizontally extracts the excess of the non-capturable elements by existing techniques and mechanism so as to restructure them in order to prepare them as much as possible for other cycles. Throughout the process, the deviations accumulate their variations too. One direction is geared towards scientific activity, accumulating potentials for future events. Another direction is produced by the ‘unidentifiable’ and ‘uncaptured’ (but somehow, albeit negatively, still identified and captured) groups of social categorizations:

La peste comme forme à la fois réelle et imaginaire du désordre a pour corrélatif médical et politique la discipline. Derrière les dispositifs disciplinaires, se lit la hantise des ‘contagions’, de la peste, des révoltes, des crimes, du vagabondage, des desertions, des gens qui apparaissent et disparaissent, vivent et meurent dans le désordre. (Foucault, 1975, p. 200)

The correlation between medicine and politics doesn’t arise from the corresponding correlation between the real and imaginary in a one-to-one conformity. Each event involving medicine and politics from their own points of view is already a combination of these two (another confusing pain in the neck for the disciplinary diagram). In other respects, this diagrammatic amalgamation, the combinatorial dosing of structuring and destructuring, framing and unframing, settling and unsettling of reality is washed away by an ambiguous ‘negative’ image couched in the real conditions of possibility of the event. The real movements of an epidemic, the contagions, unpredictability, leaps from one sector of life to another, oscillation between knowability and unknowability, resonate in the correlate movements in the social field: revolts, crimes, vagrancy, desertions, people who wear multifarious masks at the edge of life and death. Not a caged time, but a time out of its joint. Not the disciplinary mechanisms of institutions, punctually intervening in situations in a mode always already triggering in such or such ways, but the dissonant symphony of the ones scattered to the four winds, the flights over flights of the ones who feel the breath of death on their neck, the ingression of “has not been yet” in the present: a collective festival:

Il y a eu autour de la peste toute une fiction littéraire de la fête: les lois suspendues, les interdits levés, la frénésie du temps qui passe, les corps se mêlant sans respect, les individus qui se démasquent, qui abandonne et leur identité statuaire et la figure sans laquelle on les reconnaissait, laissant apparaître une vérité tout autre. (Foucault, 1975, p. 199)

Again, it is possible to read the literary fiction of the festival in two ways. Firstly, epidemics give rise to a specific genre of literature, which basically focuses on the frenetic side of epidemics in regards to social dislocation. But secondly, since antiquity literary and non-literary documents have operated as the register of social events during epidemics, which deviates from the ‘known’ and supposed limits of sociality³⁶. Foucault grasps such a moment of social dissolution in the documents he examined (basically in the Vincennes archives), and situates it as a counter-current, silently flowing in, through and beyond disciplinary mechanisms. Beggars, vagabonds, subjects of not yet identified crimes, all sorts of act that don’t enter the planned and executed rhythm of daily life, implemented by disciplinary mechanisms. “Quasi-statements” look for their visibilities, and each time, dim visibilities miss their statements³⁷. Outside makes its ingress for a moment, a glimpse remains, and the exteriority of power in regards to its interiority would be determined by yielding a cascade of categorical separations: “*fou-non-fou ; dangereux-inoffensive; normal-anormal*”.

However, from the point of view of the existing regimes of truth, exteriority is always with respect to a certain form of interiority, supposed by the functioning of the diagram. It is only functional and meaningful as long as it serves as an occasion for the creation of new categorical separations through which the elements captured by the diagram are brought together as the

³⁶ Ingmar Bergman portrays a similar situation in *The Seventh Seal* (1957), which is maybe his most optimistic movie. He zooms in on a European city landscape destroyed by wars and epidemics. The settled values of society have been corroded, religious and political institutions have lost their efficiency. Crimes and disorder dominate. A knight comes back from the Crusade, and while he can’t figure out how he survived the terrible war, he finds himself at the meaninglessness of life in the midst of the ruins. At the moment he is about to lose all hope, the angel of death appears and offers him a chance to play the final chess game of his life. For the knight, the time it takes to make each move turns out to be an instance of contemplation of the interval opened by the dissolution of the social order. Finally, when the dust of the destruction and madness has settled, the knight discovers beyond the dichotomy of life and death a kind of vivacity. As a remnant feeling from the power of devastation, he finds joy among a small family of circus actors whose game is overwhelmed in critical moments such as during an epidemic but who somehow still manage to maintain their consistency.

³⁷ Foucault finds a case of disconnection in the *lettre cachet* of the Bastille archives of the 17th and 18th century in his article *La vie des hommes infâmes* (Defert, D., & Ewald, F., 1994, pp. 237-253). These small letters of complaint written to royal authorities display the hidden corners of ordinary people’s lives. They fuse the fictional and real and give clues about the fracturing lines of discursive formations.

functioning parts of a harmonious order. Outside is not sustainable, yet omnipresent; the imaginary of a perfect order is a dream, yet real and effective:

Mais il y a eu aussi un rêve politique de la peste, qui en était exactement l'inverse: non pas la fête collective, mais les partages stricts; non pas les lois transgressées, mais la pénétration du règlement jusque dans les plus fins détails de l'existence et par l'intermédiaire d'une hiérarchie complète qui assure le fonctionnement capillaire du pouvoir; non pas les masques qu'on met et qu'on enlève, mais l'assignation à chacun de son "vrai" nom, de sa "vraie" place, de son "vrai" corps et de la "vraie" maladie. (Foucault, 1975, p. 199)

If the collective festival is the dispersal of uncontrollable forces, then the politics of the plague are a dream of constituting an order in which the disciplinary mechanisms spread into the capillary vessels of society. Each act of the disciplinary diagram finds its correlative opposite in its supposed exterior. Or rather, an outside makes its ingress in the multiplicities, diagrammatized as the dualization of segregated spaces of the interior and its hooking onto a supposed exterior. In this sense, even though correlative, the exterior and interior are asymmetrically situated in the disciplinary diagram in which transgressed laws assume a region that legalities don't have extension yet (see *les illégalismes*, pp. 261-299). The "real" names lose their proper names, their place, their body, their disease, and we can even add to this, their own death, in a continual gesture of masking and demasking their faces. And finally, all of the diagram's functioning is constantly traversed by under-currents, pushing it towards its reversal, or its dissipation, or the emergence of a new diagram. In this sense, from the point of view of the order's constitutive act of dreaming its realisation (yielding to the mechanisms), the shattering of the mechanism is felt in any instance but responded to by supplementary measures to the ends of extending the dream. Therefore, the dream of sciences to realize the perfect conformity between visibilities and stabilities as seen with the birth of the clinical gaze resonates with the dream of politics of plaque in the disciplinary societies, settling down the whole regime of truth in all layers and levels.

Beyond all the socio-historical determinations of the development of scientific discourses in regards to the birth and transformation of the clinical gaze, and of the articulation of medical discourses in the diagram of disciplinary societies, the dream of sciences and the political order correspond to a certain conceptual pole. The figure of the scientist and the politician, with all the intermediary roles of functionaries (mayors, syndics, intendants, and lastly, inhabitants), are posited as having an obligation to tell the truth. We don't need to look for these figures in distant

places. Whenever we hear the murmur of an outside, they promptly get the floor: close your eyes and lend me your ear: trust me, I'm a scientist; trust me, I'm a politician, I'm telling you the truth! And indeed, they are telling the truth. *This is the* microbe, *this is such and such* epidemic, and it can only be prevented in *this or that* way. And milieux answer their call: if I tell you I am what I am, don't trust me because I was never what I was, but I am becoming what I will have been.

Thinking of outside hits like an epidemic and everything begins afresh as it has always been. Will there be an outside of microbes?

Thinking from Outside

Foucault's *La Pensée du dehors*, in addition to being an examination of Blanchot's construction of literary space, probes certain themes such as the condition of possibility of the language that is irreducible to schemes of representation in modern literature, the affinity between the problem of outside and problem of death, and thinking of thinking itself. He doesn't contend only with crossing from one end of Blanchot's work to another, but also writes in such a style that his writing gestures Blanchot's most striking and special effects, which make the literary space a space of thinking from (of) outside³⁸. In other words, Foucault doesn't simply try to put Blanchot's work into an analytical framework but also looks for philosophical expressions for thinking from outside by thinking from outside. Blanchot's attempt at fissuring the confinement (*carcan*) of representation, therefore liberating the energies captured by it turns the classical conception of truth based on the conformity of things observed with things said (visibilities and stabilities in Foucault's jargon) upside down. Even a simple act of saying "I speak", followed by "I lie", when proposed in the literary space, suffices to shake the rigidity of the transparency of truth and to reveal an 'outside' at the heart of language. According to Foucault, this effect doesn't originate from the auto-reflexive Cartesian subjectivity of the author nor from a presupposed philosophical

³⁸ The English translators of the book, Jeffrey Mehlman and Brian Massumi, rightly translate the title as 'The Thought From Outside' (Foucault, M., & Blanchot, M. (1987)). 'From' connotes the impossibility of attributing the thinking process to the interiority of a subject. On the other hand, in Blanchot's concept of outside, what is thought is also outside itself. Each act of thinking is the thinking of outside itself, rendering itself thinkable. When the thinking emerges, it is simultaneously thought in and through outside, which comes to that it is a self-thinking of outside. For this reason, I'll shift between the use of 'of' and 'from' thinking (thought).

interiority (like in some attempts of thinking of the outside from a phenomenological stance). For Foucault, it originates from a “surface gaze” through which language escapes representations, digging up the depths of thinking, irreducible to significations designated by representation. Foucault emphasizes the affinity of this thinking from outside with death, not as a constant point of irreversibility, but as the experience of the gradual, partial deaths in Bichat’s manner. To describe their accumulation in literary space, Foucault uses a strange metaphor. He likens this process of thinking-writing to an “epidemic” that reverses the entire landscape of an allegedly known and recognizable reality. By including a strange continuity from the culmination of the scientific discourses in the birth of the clinical gaze in *LNC* to its implications in the politics of the plague in *Surveiller et Punir* and as crystallized in the diagram of disciplinary societies, Foucault presents sufficient reasons for taking this metaphor seriously and even for giving it a consistent form outside its metaphorical use.

Even in *LNC* where the epidemic has an apparent context pertaining to the history of medical discourses, Foucault’s analysis of epidemics includes dimensions that cannot be reduced to the specific field of investigation of medicine. Firstly, Foucault posits epidemics in a health-disease, normal-pathological continuum in which each disease is potentially destined to gain an epidemiological character. Secondly, the complexity of the cases compels the clinical gaze to transform itself in order to better penetrate into what is singular in each case. Whereas the point of view of each field working in the scope of the medical field maintains its autonomy with respect to other fields, while also becoming more sensitive to other fields, epidemics increasingly pressure a more global integration. This culminates in a full-fledged organization which starts from the slightest sign of an epidemic to arrive at the implication of States via detailed regulations. In this sense, in Foucault’s analysis, an epidemic is neither completely a medical phenomenon nor solely a socio-political, historical construct. So as to implicate both perspectives, for Foucault, an epidemic is principally defined by its singular-collective character, which makes it a special type of event. Even though it is always a mixture of medical, social, and political elements, an epidemic doesn’t function according to a permutational logic, but each time produces certain aspects irreducible to the already known dimensions of the fields in question. Foucault’s reference to epidemic, besides appearing in a study seemingly about literary space, would have to be about these irreducible dimensions. This time, the reference would pertain to the conditioning of death,

a certain conception of death, and emergence of singularities that cannot be encapsulated by representational structure.

Foucault finds in Blanchot's work a strange situation of modern literature³⁹. The organization of literary space cannot be explained by the pre-existence of reality or as the manifestation of an already constituted consciousness or mere literary play of words aiming at a permutational reordering of the significations. Blanchot's literary works, his novels as well as the more conceptual writings, which we can be considered as the experimental philosophical fictions, create and feed the paradoxical situation of literary space. Consequently, those works create a space in which they are able to remain in their own dimension without leading the paradoxical situation into resolution. In the beginning, it seems as if everything passes on a world we are familiar with but after a certain point, things get complicated. The reciprocal referencing among partial meaning clusters renders impossible the holding of the known limits of significations. The construction of surfaces of a network turns paradoxical exteriorities around, betoken of a void, not intended, but discovered each time by the act of passing in transit to the curves of signifying regimes. The void itself opens the possibility of installing the situation into the statements ("*énoncer une énonciation*"). Language stutters through the density of its surfaces, revealing the possibility of a speaking subject beyond representation: "*La parole de la parole nous mène par la littérature [...] à ce dehors où disparaît le sujet qui parle*" (Foucault, 1966 [1986], pp. 13-14). Emerging under these literary conditions, speaking doesn't allow to fix a categorical subject, constantly modulating itself around an organizing void, dispersing discursive elements to their exterior limits in an unreachable horizon of significations. Author doesn't speak to itself or to its exterior, but speaks the speaking of (from/through) an outside:

Cette pensée qui se tient hors de toute subjectivité pour en faire surgir comme de l'extérieur les limites, en énoncer la fin, en faire scintiller la dispersion et n'en recueillir que

³⁹ Foucault finds similar cases in the *nouveau roman*, especially in Alain-Robbe Grillet, Marguerit Duras, and Natalie Surraute. What brings these writers together despite their different motivations and styles is their concentration on the discovery of literary space's proper dimensions. They lead non-representational approaches to literature to the extreme by giving literary space absolute autonomy through which characters, things, and settings constantly change their role, shape, and framework. Most of Foucault's literary criticism collected and translated through *Dits et Écrits* appears in *Language, Counter-Memory, Practice*, ed. Donald F. Bouchard, trans. Donald F. Bouchard and Sherry Simon (Ithaca: Cornell University Press, 1977).

l'invincible absence, et qui en même temps se tient au seuil de toute positivité, non pas tant pour en saisir le fondement ou la justification... (pp. 15-17)

There is nothing to be justified, no foundation is permeable to this attempt at self-floating the language into the small gaps of things, throwing things away to their mutual scintillating with other things, capable of surpassing a certain threshold of positivity. Yet, this can still be apprehended as thinking since, rather than getting lost in the meanders of language in its arbitrary interiority, each time the stuttering of language wrenches something from the void, making it an inhabitable space. Thinking from outside is an event which achieves to not turn away from the intensity of the void:

le vide qui lui sert de lieu [to thinking of outside], la distance dans laquelle elle se constitue et où s'esquivalent dès qu'on y porte le regard ses certitudes immédiates, cette pensée par rapport à la positivité de notre savoir, constitue ce qu'on pourrait appeler d'un mot « la pensée du dehors. (Foucault, 1966 [1986], p. 16)

Now, we are utterly in a different kind of certainty. One that has nothing to do with the certainty of science, and everything to do with the paradoxical character of literary space. The gaze immediately captures a layer of things in their evanescent movement and moves to another layer in the space constituted by thinking, in order to connect one thread to another couched in the distance separating them. Thinking establishes itself in the movement from one distance to another, bringing forth a catastrophe shattering the crust of representations that constitute commonsensical boundaries but still bearable at the limits of the whole constitution's downfall. Experimentation is a creative act only when these risks are taken, when at least a shadow of devastation is felt.

This is the situation of Sorge, a character in Blanchot's novel *Le Très-Haut* (1988), who is a government office employee⁴⁰. Sorge takes time off, extends his holiday without official permission of the institution. With the connivance of his superiors, he finds himself in a situation

⁴⁰ It can be understood from the name of Blanchot's main character, *Sorge*, that there is a Heideggerian context in question. In German, *Sorge* has the meanings of worry, concern, or care. In Martin Heidegger's *Being and Time* (2010), the word expresses the facticity of being-in-the-world. In this context, *Sorge* connotes more the anxiety or worry arising out of apprehensions for the future. However, it is also thought with derivatives: *Besorgen*, being concerned with others and *Füßsorge*, being directed to others. All three constitute the existentiality of *Dasein*, facticity, being-alongside with others, and being-ahead-of-itself. *Sorge*'s journey in Blanchot's novel involves all three dimensions. We can say that Foucault's interpretation of Blanchot's text oscillates between a Nietzschean and Heideggerian context.

of almost retirement. Even this little of a gap in the organization of his daily life is enough to for things to get out of hand:

... il suffit de cette quasi-retraite –est-ce une cause, est-ce un effet ? –pour que toutes les existences entrent en déroute et que la mort inaugure un règne qui n'est plus celui, classificateur, de l'état-civil, mais celui, désordonné, contagieux, anonyme de l'épidémie ; ce n'est pas une vraie mort avec décès et constat, mais un charnier confus où on ne sait qui est malade et qui est médecin, gardien ou victime, ce qui est prison ou hôpital, zone protégée ou forteresse du mal... (Blanchot, 1988, p. 38)

Was such an interval necessary for Sorge's getting out of the way? Or were the intervals of the institution already in operation, albeit imperceptibly? An institution is defined through what and how it keeps things in place: a name, a register, parcel number, function, file, an archive for everyone! Death as the degree zero of life. But there is also another death defined through zone of indistinction of life and death. A speed that emerges from hesitation brought on by the loss of the habituated and also institutionalized preoccupations; forces that unpredictably rush in all directions. What such a temporal tearing reveals is that, as much as power formations strive to keep forces in their assigned spatial partitions, the supposed functions serve for nothing but the envelopment of forces by stationary posts, imminently awaiting to be unleashed in a play of masking and unmasking of roles. If Sorge's quasi-retirement and encounter with death in question is *like* an epidemic that scatters everything around, the singularly collective epidemic is also *like* dissolution of Sorge's activity of keeping records of other people's lives⁴¹. But it would be a

⁴¹ A similar analogy can be found with Antonin Artaud and Deleuze and Guattari between the power of epidemics and the intense processes (that of the actor in the theater of cruelty for the former and becoming for the latter). Artaud's theater of cruelty is exactly epidemic-like. In an article about theater, *Le théâtre et la peste* in *Le théâtre et son double* Artaud traces the history of the plague and makes an association between its emergence and the situation of an actor in the theater of cruelty: "*L'état du pestiféré qui meurt sans destruction de matière, avec en lui tous les stigmates d'un mal absolu et presque abstrait, est identique à l'état de l'acteur que ses sentiments sondent intégralement et bouleversent sans profit pour la réalité. Tout dans l'aspect physique de l'acteur comme dans celui du pestiféré, montre que la vie a réagi au paroxysme, et pourtant, il ne s'est rien passé*" (Artaud, 2011, p. 35). In the 10th plateau of *Mille Plateaux* titled *Devenir-intense, devenir-animal, devenir-imperceptible...*, Deleuze and Guattari trace the origin of becomings in opposition to hereditary filiations that function according to a model of encapsulation of the difference (either by the domination of representation or the signifying regimes of structures) in contradistinction to symbiotic proliferations. "*Nous opposons l'épidémie à la filiation, la contagion à l'hérédité, le peuplement par contagion à la reproduction sexuée, à la production sexuelle. les bandes, humaines et animales,*

mistake to consider this resonance simply as the common point of occasions deviating from the ordinary or transgressing the law. Rather, the law finds its real basis and universality in the ungrounded ground of the void. It gives and retreats, drifting Sorge to an unexpected, disturbing journey, yet still enabling him to survive in its whirlwind zone, and bringing along the intensity of this zone to the world with him:

Et pourtant, lorsqu'il quitte le service de l'Etat auquel il devait ordonner l'existence d'autrui, Sorge ne se met pas hors la loi; il la force au contraire à se manifester en cette place vide qu'il vient d'abandonner... (Blanchot, 1988, p. 38)

Defining a moment of collapse of the institutional system at the limits of law is not Blanchot's point for explaining Sorge's disturbed existence. Instead, Blanchot shows that each designation of the law with respect to its actualizations in institutional mechanisms misses its immediate connection with an outside and condemns it to be considered only through already formalized substance. The literary expression of Sorge's experience, despite unfolding in an institutional context, discovers in the structure of law an "unspeakable thing" (*une chose innommable*). As an 'absent absence', an informal presence, a formation of the informal, the genesis of an organizing horrific silence, it digs and constitutes its own space (p. 40).

It seems that everything indicates the reservation of a privileged place in modern literature. It is true that it opens a space for the manifestation of the unformalized substance of void, absently present in literary space. Nevertheless, this would be a quick inference since what defines the literary space in Blanchot's writing is not the designation of a place in which words lose their denoted significations. Rather, it is the manner in which an outside unfolds itself in the interstices of linguistic assemblage. Literary composition is nothing but one of expressions of the characterization of an outside with which all linguistic components are swept away. For this reason, Foucault calls Blanchot's attempt at digging a void so as to give literary space its singularity "a thinking from/of outside". He points out that the presence of the absent, the presence of informal forces makes an ingression to produce tangible effects, inexpressible in terms of existing signifying regimes, enabling direct access to the outside. This altogether makes Blanchot's

prolifèrent avec les contagions, les épidémies, les champs de bataille et les catastrophes" (Deleuze & Guattari, 1980, p. 295).

investigation not specifically “literary” but metaphysical in the sense of the emergence of unprecedented forces and their formation in a singularly dug space.

Indeed, thinking from outside as appearing in Blanchot’s literary space, which traverses the theme of exteriority/interiority in modern thought, is re-elaborated by Foucault and introduced as a potential line of thinking, radically diverging from structuralist, Marxist, or phenomenological attempts. Foucault doesn’t conceptually limit thinking from outside to only literary space. Rather, he directs his attention to the possibility of such spaces emerging at the limit of thinking the unthinkable. What interests him more is the constitution of a “space from outside”, a heterogeneous space made of “*emplacements irréductibles les uns aux autres et absolument non superposables*” as declared by him at a conference, titled *Des espaces autres* (Foucault, 2001, p. 1572). Certain spaces have an interesting feature of being in relationship with other spaces, suspending, neutralizing or inverting them in such a way that the totality of all relationships is designed, reverberated, and reflected in them⁴². Even though what characterizes a space is essentially its heterogeneity, its manner of giving heterogeneous elements a homogenous form, it is immediately covered up by the fog of the culminating points of power relations arising as a result of the related power diagram’s spatializing strategies. Yet, as we have seen in the case of Sorge, each life, institution, signpost of the power diagram is already animated by an exteriority of forces in which a homogenous form is only a partial expression. A little spark might be enough to expand the interstices in the forms, therefore giving rise to the creation of “other spaces”:

L’espace dans lequel nous vivons, par lequel nous sommes attirés hors de nous-mêmes dans lequel se déroule précisément l’érosion de notre vie, de notre temps et de notre histoire, cet espace qui nous ronge et nous ravine est en lui-même aussi un espace hétérogène (Foucault, 2001, p. 1574).

⁴² Jean-Luc Nancy calls this space “*l’espèce d’espace pensée*” in the introduction of *La dislocation* (2001). For him, as well such a disorientating situation might spontaneously arise as it can be the result of an effort. We should: “*chercher à saisir ce qui nous arrive dans notre désorientation et dans notre dislocation, une façon de chercher à nous saisir nous-mêmes en plein déplacement, en plein vol ou en pleine errance*”, Nancy, J.-L. “*L’espèce d’espace pensée*” in Benoît Goetz, *préface à La dislocation - Architecture et Philosophie*, Paris, Les éditions de la Passion, 2001, p. 252.

* * *

We are drawn out of ourselves all the time. Our lives are always subject to erosions, open to the gnawing and ravaging of heterogeneous spaces. Yet, we don't always possess the possibility of sustaining and feeding those spaces as such. The history of human beings' relationship with microbes wasn't only determined through their negative effects. The image of the pathological microbe definitely carried the agenda given the devastating effects, especially in the case of epidemics. However, even in the preliminary categorizations of microbes, fascination was always at work. It was already felt that they were not simple automats, behaving according to mechanical principles; an awareness which gave rise to different philosophical elaborations. In this sense, the scientific space of investigation of microbe was already a heterogeneous space, but the inherent conditions of scientific experimentation were destined to produce categories, though susceptible to all sorts of disturbances and transformations. Whenever there was a question of dealing with a microbe-induced situation (experiment, disease, or epidemic), the principal microbe categories at hand dominated the agenda. This can be said to be as a result of a given *reflective judgement* through which the *concept* of microbe was produced and particular behaviours of microbe species explained in the general setting of scientific activity.

Epidemics are critical events in which this conceptual judgement is tested. On the one hand, it requires a great convergence of scientific, social, and political aspects for diagnosing, controlling, and administering the situation. On the other, epidemics are essentially defined by their uncontrollable aspects, revealing a certain insufficiency at all levels, urging the mobilization of different perspectives. Therefore, the diagram of power relations that makes possible such a convergence displays the exteriority of the epidemic, not only with respect to the already positioned interiority of forms, but as a sign of the ingression of an outside. Outside might take various expressions. But in the case of an epidemic, its expressions come with devastating effects. Then, maybe, maybe, after-the-fact (*après coup*), after everything is said and done, an epidemic can be replayed in thinking. It might be replayed and undone in thinking, because its traces (absent presence) still stir in uncaptured dimensions, still agitating the whole field: epidemic as the pure event of the surplus, the manifestation of the uncontrollable.

For this reason perhaps, the literature on epidemics has been either the bureaucratic type of writing through government archives in all their dullness, or the type, implicitly or explicitly

enchanted by the situations arising from the disruption of the social order⁴³. Even this last type of writing is too embedded in the repercussions of the social dissolution and considers the epidemic only in its arbitrary character of leading to catastrophic events as any other destructive event might. The question of the possibility of an aesthetics of epidemic, and relatedly, that of microbes, arises at this moment. How does the destructivity of the world, or everything exceeding the boundaries of the possibility of the reflective judgement turn into an aesthetic engagement and conditions an aesthetics of beauty? Now, it is time to inquire into the possibility of an aesthetic judgement in regards to microbes and with respect to Whittaker's work.

A Microbe-Aesthetics

In Whittaker's *Ambient Plagues* and *Shiver*, what makes an aesthetic experience possible is that reference to microbes creates a tension, an "uncomfortable dialectic". On the one side, filmic images reflect the horrific side of microbes in parallel with governmental regulations aimed at controlling the destructive side of microbes. On the other, we see beautiful images of microbes produced by means of biological laboratory, created as a kind of bio-sculpture. These two sides come together in the symbolism of biological objects, the petri dish or 'created' organism, and materiality of biological processes. In this way, the boundaries between cultural and scientific, artificial and natural are blurred in the structure of the works. Two apparently bifurcated paths of understanding and approaching microbes come together and produce ambivalent feelings, oscillating between fear and beauty, with the second predominating over the first. They are sufficiently distanced from each other to have a certain kind of autonomy, while at the same time constantly referring to each other in their functioning. This mutual underpinning between the pathological conception of microbes and the possibility of representing them as objects of beauty (in order to resolve the tension between them) brings into fore the question of aesthetic judgement. In the unsettling situation of feeling both fear and beauty with respect to microbes, Whittaker's

⁴³ For a comparative analysis of contemporary ecological crisis conditions, the proliferation of catastrophism discourse and the romantics' way of conceptualizing disaster, see Morton (2012) (<https://romantic-circles.org/fpraxis/disaster/HTML/praxis.2012.morton.html>, Accessed 30 September, 2019).

work is at an interesting crossroad with Kant's effort of thinking the judgement in its different aspects, reflective, aesthetic, and biological.

The judgements couched in Whittaker's work oscillate between the reflective aspect in the references to science and the aesthetic aspect in the feeling of fear and beauty with respect to the effects of microbes. Horrific filmic images step in place of devastating effects of epidemics while, the beauty of microbes is produced by biological and artistic means. Together, they open into a non-scientific field, meeting with spectators in the art gallery. The quality of beauty manifests itself in the work only with respect to fearfulness of microbes. The intensity of the horror and unsupportable is moved to the background, yet immediately felt in the contours of the feeling of beauty. Under what conditions does such a background appear? What gives its power to immediately affect the apparition of an object, thus creating the possibility of an aesthetic judgement from the point of view of the spectator? If the scientific concept of 'microbe' represents a harmonious totality between the observed properties of microbes in laboratory and the fitting categories in biological discourses, the faculties of sensibility and cognition are mutually adjusted. How, then, to interpret this accord in terms of the excessivity of epidemics? Finally, between these two, how does the feeling of beauty arise, and how is it founded on the possibility of aesthetic judgement? What do all these discussions mean when thinking of microbe-aesthetics from an ecological perspective?

We will traverse these questions quickly through Kant's philosophy to come back to Whittaker's work.

From Aesthetic Judgement to Becoming

Kant's theory of judgement aims at encompassing all fields of human experience. A judgement, for Kant, is not only an act of giving a definitive form to a supposed object by the cognitive process of discriminating properties but itself a faculty defined as "the capacity to subsume under rules, that is, to distinguish whether something falls under a given rule" (Ginsborg 2014, quoted from Kant 1781, p. 132)⁴⁴. *The Critique of Pure Reason* is devoted to showing how

⁴⁴ In the English translation of *Critique of Pure Reason* by Paul Guyer and Alan W. Wood (1998), this sentence is translated: "If the understanding in general is explained as the faculty of rules, then the power

the reflective judgement is possible in the experience's conditions of possibility, and how the faculties harmoniously function in order to fulfill the task of producing representations. However, the faculty of judgement as such, separate from the other primary faculties of sensibility, imagination, and cognition, finds its real basis and condition of possibility only in the third critique. *The Critique of Judgement* (1790) presents a theory of aesthetics as the ultimate foundation of both the autonomy and concordance of the faculties with each other. Under this logic, in the normal course of things, I am easily able to represent a table in front of me by virtue of the receptivity of my sensibility and the spontaneity of my understanding. When it comes to judging a table as beautiful, however, things get complicated; a matter of taste and distaste comes into play. The force of Kant's analysis of judgement is to show the objective basis of this seemingly subjective feeling, manifesting itself primarily in the beauty of natural objects, and culminating in the sublime aspects of nature that have their correlative expressions in art fields. Interestingly, Kant terminates his analysis of judgement through the examination of the purposefulness in living beings by comparing the nature of judgement with mechanistic principles of the physical world. What is *critical* in the judgement is precisely this paradoxical situation of disconnection and articulation with things in nature. This situation reaches a peak in the feeling of sublime, which in fact drives the faculties into devastation at the edge of chaos, but in the end, which arrive at a state of equilibrium in the disequilibrating conditions. While according to Kant it is impossible to fill the gap between nature and artefacts produced by human beings, he recognizes the existence of unforeseen effects when encountering certain events in nature or culture, which may shake the integrity of human consciousness. When human beings are able to support these conditions, they create beautiful objects that give rise to contemplation in which the faculties, especially imagination, reach free range, in turn serving as food for thinking. When we are in front of a beautiful object of art, we *indirectly* contemplate nature, which is an activity that culminates in the emergence of new concepts.

Considering the problematic status of the feeling of beauty in relationship with feeling of sublime, what can we say about the representation of living beings in art? If reflective judgement

of judgement is the faculty of subsuming under rules, i.e., of determining whether something stands under a given rule (*casus datae legis*) or not" (p. 268). The translation I used is from the Stanford Encyclopedia of Philosophy article, entitled *Kant's Aesthetic and Theology* written by Hannah Ginsbourg, Fall 2014 Edition, <<https://plato.stanford.edu/archives/fall2014/entries/kant-aesthetics/>>. Accessed August 13, 2019.

is what determines the properties of living beings according to a taxonomy of genera and species, what is the role of aesthetic judgement in relation to natural laws? How does beauty appear in microbe-artworks? How does it embody the characteristics of living beings in its own and harmonious way in a microbe-aesthetics?

* * *

To elaborate on these questions and look for answers, instead of revisiting the aesthetic theory of Kant in its totality, I will follow one of Deleuze's early texts on Kant's theory of judgement, *L'idée de genèse dans l'esthétique de Kant* (1963; also taken in 2003). In this text, Deleuze suggests that the specificity of aesthetic judgement arises from the idea of genesis that also conditions other types of judgements and functions as a ground (*fond*) for the synthesis of sensible diversity. It is the 'emergence' of this ground what facilitates the harmony between the faculties. The task of Kant's first critique is to explain how a sensible diversity is subsumed under a concept by an act of judgement. For this, all faculties work in harmony, and the operations of understanding basically govern the process, legislating the other faculties to play certain roles. Although each faculty maintains its own autonomous field of activity, their role is essentially determined by the finality traced by understanding. Understanding ensures the continuity of the functioning mechanisms of synthesis in regards to the perception of manifold of sensations (respectively, apprehension, reproduction, and recognition).

In the third critique, *The Critique of Judgement*, an examination of the faculty of judgement, the roles change because the order of the synthesis is fractured within aesthetic comprehension. When we find something beautiful, imagination and understanding come into an agreement without the legislation of one over the other. Imagination exercises freely without being submitted to the schematism addressed by the understanding as in the case of the production of representations in the first critique. Rather, starting from the feeling of pleasure arising from the singularity of the contemplated thing as beautiful, imagination gains free range, reflecting nature's ability to produce beautiful forms in a disinterested, undetermined way. Yet, it meets again with understanding, not to apply a submitted scheme, but to find a harmonious form to what is reflected through aesthetic pleasure. In this way, imagination and understanding are once again brought into accord. While imagination offers the lure for thinking for understanding, understanding procures

new concepts in analogy with the posed object by imaginative reflection: this is not a flower object whose form I am used to, but is a beautiful flower in which we see the innocence of beings, for instance. Therefore, the faculties proceed on again in a harmonious way, and the question of why a hiatus emerged between them in the first place remains unanswered in the scope of the analytics of beauty. On the other hand, even though the imagination exceeds its already assigned boundaries, it cannot really find its transcendent exercise, that is, the limit of what it can do, and therefore, cannot reach its full range of activity. The experience of sublime will not only indicate the total dissolution of faculties, but also serve as the ground that explains where the capacity for legislation of faculties, and consequently, harmony among them arises from in other critiques (theoretical reason and practical reason).

However, the experience of sublime that Kant considers as a totally separate aesthetic category, completely shatters the harmony between faculties and throws the imagination into waters it does not know or is unable to recognize. The sublime is an experience of dizziness or vertigo before an ungraspable aspect of nature. In the feeling of sublime, perception loses its reference points onto which it ordinarily holds in the functioning mechanisms of representation. This is also a catastrophic event because the structure upon which the mechanisms of the production of representation depend through the reproduction of the units of measure constantly looked for as reference points for the unitary foundation responding to the diversity of experience comes to a point of collapse. Experience itself becomes incommensurable with the repertory of units of measure, provided and accumulated by the structure of the pure reason. In other words, it brings us to the edge of chaos. A flood, fire, avalanche, hurricane at sea, etc. (Kant's own examples) might reveal the fundamental fragility constructing the texture of reality, and as a result, destroying the harmony between faculties. The imagination is subjected to a violence that throws it into its limit of impotency. While imagination finds itself in the midst of unleashed forces, trying to catch the waves of extraordinary variability of the dimensions of such an event, reason strives to harness the imagination's running amok, and to convert its adventure into the presentation of Ideas. Now, Ideas become not simply the images of the represented object but are directly connected with the suprasensible world. A possibility of re-establishing an accord between the faculties re-emerges, yet under totally different circumstances:

Raison et imagination ne s'accordent qu'au sein d'une tension, d'une contradiction, d'un déchirement douloureux. Il y a accord, mais accord discordant, harmonie dans la douleur.
(Deleuze, 2014, p. 87)

Here, we find in the analytics of sublime what we couldn't find in the analytics of beauty: an accord issuing from conflict, a harmony of the discordant, founding the possibility of any aesthetic experience, in both artistic and sensible sense and their penetration into the ungrounded. It is precisely in this sense that the analytics of sublime condition all kinds of aesthetic experience in which the imagination arrives at full range of its activity. Imagination finally detaches itself from the framework of understanding and from the obligation of applying ready-made schemes. At this moment, Kant discovers that the presentation of Ideas exceeds the ordinary cycle of the ideation of objects, meeting with the suprasensible world. For Kant, aesthetic comprehension of the suprasensible world doesn't only constitute and re-guarantee the legitimate functioning of the faculties but also presents an occasion for re-founding the all-encompassing character of Reason (that will culminate in Hegelian dialectics of *Geist*).

In this regard, in a totally different philosophical project, Deleuze significantly deviates from the Kantian attempt at backing the suprasensible into the scope of Reason. In *Sensation* (2012), an article about Deleuze's concept of sensation treated in *La logique de la sensation* (2014), Daniel W. Smith illuminatingly shows that Deleuze insists on the complexity of the sub-representational world and its independence from preoccupations of Reason. Breaking the perceptual synthesis, when taken seriously and brought into its ultimate conclusions, reveals deeper temporal scales which conditions the units of measure that ordinary perceptual synthesis functions: the rhythm. Aesthetic comprehension is a grasping of the rhythm beneath both measure and units. In other words, Ideas are not mental representations of sensible diversity, but reveal the intensities that lie behind sensations. Beneath space and time as external and internal *a priori* forms of the mind and the condition of possibility of experience, there are spatiotemporal dynamisms occurring at sub-representational and preindividual level, which are the real conditions of experience: nonhuman or inhuman *becomings*: a life⁴⁵.

⁴⁵ A few remarks here about Donna Haraway's critique of Deleuze and Guattari's concept of becoming in *When Species Meet* (2008). Haraway comments on the concept of becoming in *A Thousand Plateaus* (1987). Her interpretation ceases to take up the complexity of the arguments presented in this 10th plateau. In the first place, she equates becomings to the notion of sublime. Although she never specifies the meaning

An Echology of Elaine Whittaker's Work

The form of “this is a microbe” is provided by reflective judgement, which extends from the first observations of microorganisms, conceptualized under the name of animalcules, to basic scientific categories that explain the conditions of being-microbe. In all the contexts in which the being-microbe has taken a certain form, a sideways also appeared that remained exterior to existing categories. This sometimes turned out to be the bifurcation of research paths within scientific activity itself and sometimes emerged as an uncontrollability in the case of an epidemic in which microbes exhibited their powers en masse. Microbes' highest power emerges at this moment, in their massive effect, sweeping all of the world's settled formations and meanings. Beyond the human, a window opens into the more-than-human: a crack. In contradistinction to the “being-microbe” defined by particular forms, functions, and structures embedded in different fields of activities, we can define this universal form of microbes' uncapturability as ‘microbially’. Microbially is what distributes the potentialities of being-microbe over the fields as their ground, while remaining ungrounded itself. Interestingly, this apparition of microbially is precisely the ungrounded ground of creativity in human activities. Science as the depiction of the unknowable through microbial functions and the discovery of regimes that bind them together; art as the creation of cross-referencing of sensory modes of the impenetrable with and beyond biological laboratory practices; and thinking as the unhinging of the unexpected through the conceptual

of sublime, we can infer from her comments that it is the traditional meaning of sublime as the mythification of symbolical realms as the only possibility of transcending the given conditions of the cultural domain. When she takes the concept of becoming as sublimation, then the question of becoming is reduced to epiphenomenon. “All worthy animals are a pack; all the rest are either pets of the bourgeoisie or state animals symbolizing some kind of divine myth” (p. 29). Yet, Deleuze and Guattari's analysis only secondarily produces a meaning with respect to the bourgeoisie or divine myth, which should be evaluated according to the singular coming together of the regimes of signs in different cases. The reasons for designing a ‘concept’ of becoming and what it does essentially lies elsewhere. The main aim is to explain change, transformation, and metamorphosis without falling into any form of substantiation which accepts certain ‘actual’ forms already given in some privileged areas of human activity (in the case of Haraway, evidently biology). This task can only be performed through the elaboration of a problematic field (actually many) in regards to the question of ‘what can bodies do’. In this respect, the spirit of the chapter about becomings is more Spinozist than Kantian (if we would take the term sublime in Kantian sense). Moreover, as I have tried to show in this chapter, Deleuze's relationship with Kant himself, and even more so, Kant's own concept of sublime is problematic and presents many difficulties.

elaboration of the problematic designation “microbe-artworks”. Whittaker’s work potentially contains these three dimensions. In the “symbolism” of microbes as beautiful, these questions give rise to the problem of a “microbe-aesthetics”.

In Whittaker’s work, an unsettling situation arises from the transformation of the consideration of microbes as destructive, harmful, and lethal entities to their contemplation as beautiful beings. The petri dish emphasizes the role of scientific discourses, techniques, and methods determinant in how we conceive microbes. *Ambient Plagues* hosts two seemingly contradictory notions of microbe, both based in scientific discourses, both inducing corresponding images; one fearful, the other beautiful. A beautiful image of microbes produced under biological laboratory conditions is overlapped with images of fearful expressions captured in dystopian movies about pandemics. Fear and beauty are two sides of the same coin in *Ambient Plagues*. The terrorized face we see in the background is only meaningful with respect to the fearful effects of pandemics on individuals as represented in popular culture movies and by the presence of the image of bacteria.

Do movies consolidate the horrific image of microbes or does a certain scientific conception of microbe precede the production of such representations? Is a microorganism that has been grown in a biological laboratory more natural than the fear emerging as a result of pandemic disasters? Do we contemplate the movies that we watch as an image of pandemics and microbes or is a microorganism in a laboratory already contemplated through what we don’t directly see, both in an epistemological and biological sense? It is as if a thin line backstitches the cultural production of microbial images with the visualisation of microorganismic qualities in three dimensions that consolidate the idea of harmony and beauty in nature. A scientific term is always in contact with extra-scientific dimensions. These dimensions are integrated into political diagrams, and as a result, become part of wider social effects and transformations. A conception of microbe defined based on a pathological understanding, and, therefore, devastating character primarily evokes the necessary political measures, regulations, and consequently annihilation methods. On the contrary, a beautiful image of microbes based on different scientific premises and discourses implies a different sort of relationality. Whittaker’s work, as a reflection of this transformation, accentuates the latter mode, opening unexplored paths in our relationship with microbes.

In another installation *Shiver*, Whittaker once again accentuates the beauty of microbes, this time putting them together in companion with real statistics of recent Ebola pandemics. *Shiver* underlines the materiality of two currents traversing two different conceptions of microbe and their implications in human response and the strategies of governing epidemics. The installation insists on the centrality of the petri dish in accommodating the materiality and complexity of microbes. Whittaker uses 2300 petri dishes with pipette tips, putting them together with grown salt crystals, digital photography, as well as copper wire grids that represent recent Ebola pandemic statistics into a kind of biomorphic sculpture. The fear of infection and pandemics is represented with a certain sense of sterility as found in the antiseptic appearance of the gallery white walls against the imminent danger of microbes. For coping with the unexpected and sudden threat of microbes, statistics are crucial instruments for tracking an epidemic. Governments and institutions are mobilized to integrate the scattered data in different fields, govern populations, and finally, take measures for controlling the epidemic. The viewers oscillate between the shiver of the possibility of imminent death in an epidemic despite all the sterilization attempts of the environment and the shiver of the possibility of an aesthetics of in a sculpture like assemblage, shifting between fear and beauty.

An epidemic emerges at the limit of the functioning mechanisms of the already spatiotemporally partitioned fields of reality, confronting them with their inability. It finds its ultimate figure in the “unformed” or “deformed”, revealing the relevancy of the ungrounded in the grounded and inversely. From the point of view of the fields’ inability to comprehend the emergence of the unexpectedness of the ungrounded, everything is already too much, too strong, too overwhelming. Consistency of fields of activity is at the edge of collapsing entirely. But from the point of view of the event itself, forces of Nature are unleashed. What was once captured returns with the uncapturable; life-taking processes immediately enter into a zone of indistinction with life-giving ones. They envelop each other in the singular-collective character of the epidemic. The factor that enables the fields to reorganize themselves together in a relatively new basis is this form of exteriority, which will culminate in the thinking of outside as its most consistent form. In Whittaker’s work, the destructivity of the epidemic is captured through pandemic movies. The fearful face expression of the characters reveals not only the lethal character of epidemics and microbes, but also their becoming a sort of scapegoat for political ends, therefore reflecting an exaggerated image. That the lethal character attributed to microbes in the pathological

understanding and its political implications refers to a fictional domain remains secondary with respect to the passage from the destructivity of epidemics to the possibility of conceiving microbes as beautiful living beings. We do not only survive epidemics, but also conceive through and in contrast with them the beauty of microbes in an uncomfortable dialectic.

The beautiful image of microbes is not independent from the fearful and destructive aspects of epidemics, whether exaggerated or not. On the contrary, it only makes sense when the two are juxtaposed in an uncomfortable dialectic. The singular-collective character of epidemics creates a feeling of perplexity and inevitability. However, at the same time, it conditions and sharpens a more or less harmonious conception of the world, which will serve as the basis and occasion for producing beautiful images of microbes. In this way, a rift emerges between reflective judgement and aesthetic judgement, yet, connected to each other, granting some properties that cannot be squeezed into perceptual qualities but might be reflected through them in an analogical way. Sciences expand the gap, sometimes more, sometimes less, but in any case, cannot ever close it. With the possibility of aesthetic experience, however, the movement proceeds in two ways. A movement from the aesthetic judgement to the reason, both conditioning and restructuring their mechanisms, and from the reason to the aesthetic comprehension in terms of the reason's concordance with the imagination under discordant conditions. Whittaker's work accommodates this contrasting situation under the *symbolism* of the petri dish. The petri dish is not only an evocation of the necessary procedures in the emergence of scientific objects, but also appears as an aesthetic object in itself. In this way, while each moment itself refers to its contrasting correlate, they both dissolve in the beautiful image of the microbes.

By passing through many intermediary stages, this return to the experience of beauty of microbes in the aesthetic judgement, inserts at the very heart of any kind categorisation of microbe a destabilizing, yet productive tension. Beneath a concept of microbe, there are spatiotemporal dynamisms. The spatiotemporal dynamisms consist of blocs of rhythm, having complex patterns in communication with each other. When a certain pattern sufficiently repeats itself, in other words, iterates 'more or less' the same rhythmic blocs, it exceeds a certain threshold and gains an epistemological value. Reflective judgement is now able to synthesize sensible diversity, gaining a concrete determination that yields categorical forms relevant for each spatiotemporal dynamism. But a categorical determination is essentially defined as nothing but by the rhythmic blocs'

capacity of deviation. What the epidemic displays is not merely a brute force of destruction, but the participation of the fields in this rhythmicity through a cross-sensitivity or interference of unattuned rhythmic patterns. In this way, from the scientific consideration of microbes to institutional regulations, a certain dose of microbiality is injected to all forms of being-microbe in a dynamic of transformation in the very tissue of event(uations).

Each layer's unit of measure for each layer in the fields is conditioned according to its own level of stratification and by the movement of the rhythmic blocs that put the categorical determinations into a slow but continuous path of change. Each categorical determination a microbe gets is a pulse of rhythmic movements basically characterized by nonhuman and inhuman becomings. The production of beautiful microbe images is an attempt at approaching this level of becomings.

Echology is the thinking of approaching and distancing, measuring the degree and level of consolidation of the layers as stratometer and their speed of oozing from the fissures as anemometer. The problematic field of each chapter will show to what degrees they are put into operation and modulated.

Chapter 3

Performing *The Unsettling Eros of Contact Zones*: Microbe-Ecologies

What drives one to develop a deep relationship with microbes? What motivates one to build projects with microbes in engagement with sciences, yet in a different context?

* * *

Our relationship with microbes has various forms. Interesting situations arise when artists are concerned. They learn from the sciences, apply what they have learnt into their artistic practice, but in the end, accomplish something different than the sciences. There is an aspect of a microbe-art project that both crosses science and is irreducible to them. In a way, artists feed on resources other than the sciences in the construction of a project. How should one understand the inclusion of these resources in a project together with the aspects related to scientific activity in terms of the produced work's dimensions? To understand this, it may be helpful to talk to the artist directly.

In an effort to understand an artist's work better and in preparation for the interview, one can examine the artist's previous work, their own articles on the subject (if there are any), the authors cited in these articles, and any other interesting situations that can turn into a question. What is it like to be in a biological laboratory as an artist? What motivates you in a project? How do you see the influence of such and such author in your work? Do you have specific strategies for displaying your work in an art gallery⁴⁶? The formulation of such questions regarding specific

⁴⁶ As part of this dissertation, in order to conduct interviews with artists and scientists, I applied to the ethics committee of *Université de Montréal, Comité d'éthique de la recherche en arts et en sciences* (CERAS), which aimed at evaluating research projects and developing responsible research conduct in the context of the university (this committee is no longer in service). Since I had no experience or knowledge of conducting interviews in an ethnographic context, I drafted the question protocol in a very intuitive way. Some of these questions have been very useful. On the other hand, I should point out that the interviews often progressed in a more or less spontaneous manner. I analyzed the data gathered from the interviews in a means designed to address the various philosophical questions at hand in the chapters.

projects is taken as part of how the work is understood. On the other hand, the main purpose of an interview has to be, to some degree, the hope of catching a small statement, connection, sentence that may not seem interesting at first but somehow remains in your mind. Such an expression may change one's understanding of the work, how you conceive the components of the work, the way they come together in composition. If ecology is basically concerned with complex interactions in which different elements interact with each other, is it possible to also talk about an ecology of an artwork? What about these little detours, minor expressions, effects that seem like an inspiration at first; what kind of an ecology would this be considering the composition of the work⁴⁷?

* * *

At the center of Tarsh Bates' project *The Unsettling Eros of Contact Zones*, there is the yeast fungus *Candida albicans*, a microorganism found in the cavities of the human body, especially in women, that causes thrush in the human body. Once treated as thrush, the first thing to probably come to mind is to destroy it. Could a living being exist just to disturb human beings? Apparently, not:

⁴⁷ The use of the word ecology in non-scientific contexts has already entered the field of humanities. Media ecologies have especially come a long way in creating the conceptual tools for mapping the interrelations between bodies. In media ecologies, philosophers such as Heidegger, Whitehead, Simondon, Nietzsche, Deleuze and Guattari, as well as media thinkers such as Marshall McLuhan, Lewis Mumford, Harold Innis, Walter Ong, and Jacques Ellul come together under different problems and themes. See for example, Fuller, M. (2005), *Media Ecologies. Materialist Energies in Art and Technoculture*, MIT Press; Taffel, S. (2019), *Digital Media Ecologies. Entanglements of Content, Code, and Hardware*, Bloomsbury Academic. For an exercise in media ecologies' approach to different problems, see *The Fibreculture Journal 17* (2011). Here, ecology refers to the wider set of relations in which bodies, assemblages, and forces in-form each other in a process of transformation, consolidating, stabilizing, forming or deforming their capacities in a state of emergence. In this regard, ecology can also be considered in this context of mapping the ecologies of non-humans on different scales and through different objects and discourses. At the same time, the real emphasis in this mapping attempt is on the emergence of "echoes", which trigger contact with these ecologies and draw a non-teleological trajectory for them. Thus, the expression of the mapping in question arises as a question in thinking and writing. In this sense, ecology shares a kinship with Isabelle Stenger's concept of "ecology of practices". Different sorts of knowledge co-exist, -adapt, and mutually influence one another in an ecology of practices. See Stengers, Isabelle (1996), 7 vol. Paris/Le Plessis-Robinson: La Découverte/Synthélabo.

Candida albicans is a fascinating creature. They perform in our bodies. I fell in love with it. Then also *candida* never grows just as one. You can occasionally find them in your body always as a colony. It's a multiplicity. This is really interesting. Microorganisms are completely social. They communicate⁴⁸.

Ecology of an artwork would have to related to the unfolding of this fascination. Fascination is what traverses a work from beginning to end. It provides a propulsion for the creation of a project and collects various elements en route; its effects continue in the project itself, even after everything is done. Bates' project starts with *Candida*. Our access to this microorganism's abilities is only through the scientific context. But the relationship with the sciences is itself problematic. There is no doubt that *Candida albicans*' scientifically determined properties such as its high environmental responsiveness and the ability to shape shift, crossing different modes of relationality between commensalism, parasitism, and sometimes symbiosis, are themselves the source of fascination. But these properties of *Candida albicans*, however, also bring some things into question. In the first place, how are we to distinguish the borders of an organism? This carries one aspect of the project into an immunological discussion, pointing to a certain internal tension in immunological discourses. One side of those discussions points in the direction of the elaboration of a full-fledged notion of organismic self, which is based on conflict and competition. The other points to a more ecological understanding of organism and nature based on mutual solidarity and collaboration so as to include all the factors disturbing the self-similarity.

Nevertheless, in order for Bates to engage at the level where *Candida* performs its abilities, her relationship with the sciences does not remain only on an intellectual level but requires doing with science. With a background in biotechnology as well as the arts, Bates has her feet in both fields. Bates' artistic projects are inspired by scientific findings but constructed to produce different outcomes. She borrows from the sciences their procedures, protocols, methods, and techniques, implementing them into her practice so as to "push the materials to be able to do different things"⁴⁹. In this direction, she benefits from different veins of cultural theory, critical

⁴⁸ Tarsh Bates, personal interview with the artist, Berlin, November 23, 2017.

⁴⁹ We can draw attention to the parallelism in this approach with Oron Catts and Ionat Zurr's conception and design of "semi-living" beings. The "semi-living" beings are created under biological laboratory conditions as "non-utilitarian, non-instrumental and frivolous" artworks (Catts, O., & Zurr, I., 2012, p. 260). The aim is to create artistic expressions that challenge the settled meanings of biotechnology, engineering, and politics. The result is "neither utopic or dystopic but rather ambiguous and messy" (p. 260). Just as in

studies, STS, and feminist theory to name a few. Situating herself in the midst of different inspirational and practical tools, Bates utters the vocation of “microbioartist”⁵⁰: “I’m a scavenger”. Scavenged materials should be composed in such a way that the capacity to unexpectedly respond to given situations emerges, always indicating more than one path of response in a process of becoming. In this way, Bates scavenges Donna Haraway’s concept of “response-ability” (Haraway 2008, quoted in Bates 2015; also personal communication) that defies the self-similarity supposed by fixed taxonomies but still takes them into account as factors among others in the multiple interactions between “different material-semiotic systems” (Haraway, 2008, pp. 4-5; p. 71). And so, an idea emerges, one that will gather all these tensions at its heart and carry them into the art gallery environment: making bread leavened by *Candida* and offering it to the gallery visitors. Bates’ fascination with *Candida* yields to an affective-conceptual investigation in which the art gallery is transformed into a site of experimentation that brings scientific approaches, protocols, and methods, and artistic methodologies and sensibilities together.

Now, we already have the three main axes from which to investigate how the elements that make up *Eros* come together. The first axis follows a certain historicity, delineating the tensions in immunologic notions. An ecological sensibility that conditions the work is one of the themes of this historicity. The second axis marks Haraway’s influence on Bates’ projects. Haraway’s analysis of immunology and contact zones of companion species are woven into an engagement with sciences as the ground for the production of “alternative facts”. On the third axis, these two axes meet with laboratory practices. All these elements eventually arrive at a fourth axis, an ethical-aesthetical approach than an axis, which appears as the outcome of the whole process. And there

for the case of Bates’ project, what is important in Catts and Zurr’s work is the situations that escape from the paradigms of technological or political control: “Rather than celebrating the technological approach to “life”, we look at how life asserts itself as a context based materiality, defying human and technological controls. We celebrate failure and embrace futility. We rejoice life” (Catts, O., & Zurr, 2016, p. 135). For an analysis of the discursive complexity of Catts and Zurr’s work—*Disembodied Cuisine* and classification of biological artistic practices in general, see Hauser, J, (2005), *Bioart - Taxonomy of an Etymological Monster*, 2005, *Hybrid: Living in Paradox*, pp. 182-193.

⁵⁰ Bates used this term in the title of a talk at the interdisciplinary conference, “Nonhuman agents in Art, Culture and Theory” organized by *Art Laboratory Berlin*, where this interview took place. The title of the presentation was “On Being a Microbioartist: Making Art in a Microbiology Lab”. For more details, see <https://www.artlaboratory-berlin.org/html/eng-event-40.htm>.

are little whispers, little touching between each axis and conditioning the passage from one axis to another.

Revisiting the Immunologies

Bates' engagement with the life sciences and living beings comes with a political sensibility towards the environmental crisis and regulatory regimes aiming at controlling life processes. *Eros* presents an interesting case in terms of the passage from the pathological understanding of microbes to an ecological one, this time bringing an immunological discussion into question. The immunological discussion about *Candida* takes an important place in terms of how we relate ourselves to *Candida* and as a result, how this shapes our actions. In her article *We Have Never Been Homo Sapiens: CandidaHomo naturecultures* (2015), Bates revisits contemporary scientific immunological discourses about *Candida* and observes that militaristic metaphors still predominate the field's agenda. According to these approaches, a notion of the self stresses the clearly delineated, stable boundaries of the individual in its relationship and opposition with exterior conditions that constitute a constant threat and are conceptualized as a non-self. In the case of *Candida*, military metaphors such as "immunological shields" (Gow & Hube, 2012, p. 408), "escape mechanisms" (Netea, Brown, Kullberg, & Gow, 2008, p.74), and "host defense armory" (Cheng, Joosten, Kullberg, & Netea, 2012, p. 1304) (all of them quoted in Bates, 2015, p. 26) are mobilized to explicate the defense mechanisms of organism in regards to the disrupting strategies of *Candida*. The immunological discourse's repertory of metaphors is not inoculated from the use of the war rhetoric in the political field. Haraway remarks that changes in the political scene affect the selection of metaphors in immunological discourses. For instance, while the cold war era brought the imminent threat of nuclear armament to the forefront, after the fall of socialist regimes, the rhetoric evolved into a semiotics of surveillance and terrorism (Haraway, 1991): "Clandestine sleeper cells lurk, hidden, ready and waiting, necessitating constant vigilance" (Bates, 2015, p. 26)⁵¹.

⁵¹ From the perspective of social sciences, there is a growing interest in immunology, deepening the history of immunology and raising philosophical questions. For a history of immunology, see Moulin, Anne-Marie and Alberto Cambrosio (eds) (2001), *Singular Selves: Historical Issues and Contemporary Debates in Immunology*, Amsterdam: Elsevier; Anderson, Warwick and Ian R. Mackay (2014), *Intolerant Bodies: A*

This sensitivity to politics also finds its corresponding expressions in the studies conducted on *Candida*. Despite the field of immunology being complicated with other metaphors that describe colonies as farmers or adventurers, accentuating more cooperative interactions between host and microorganism, a dichotomous approach to conceptualizing the immune system remains central and is reproduced each time. As Ed Cohen argues (2004), whenever self is distinguished from non-self, autoimmune diseases are left beyond the scope and the conceptual scheme fails to explain the complex behaviors of certain microorganisms that may act in both commensal and pathogenic modes (quoted in Bates, 2015, p. 27)⁵². All these different scientific elaborations at the taxonomical and conceptual level play a certain role in the trajectory of scientific research as well as in artistic practice. However, Bates' artistic practice scavenges other fields, theories, and frameworks, from public health, commodity culture, and critical theory to science and art studies in order to open certain ways of doing embedded in scientific activity into larger conceptual, cultural, and affective perspectives. This chapter will look at how Bates' artistic process in *Eros* is situated in relation to these fields. To do that, it will be helpful to first more closely examine the emergence of the self/non-self discrimination in immunological discourse—its bifurcations and side-streams, and the development of more ecological approaches. *Candida*'s fascinating abilities such as its shape shifting, capacity to act in both commensal and pathogenic ways, strategies of undetectability, etc. will resonate in the field of immunology through the elaboration and transformation of terms like identity, self/non-self, organism, disease, and the environment.

Short History of Autoimmunity, Baltimore: Johns Hopkins Press; Cohen, Edward (2001), "Figuring Immunity: Towards the Genealogy of a Metaphor", in Moulin and Cambrosio 2001: 179–201. For the philosophical reference to immunology, see Baudrillard, J. (2002). *Screened Out* (C. Turner, Trans.). London, New York: Verso; Derrida, J. and Vattimo, G. (Eds.) (1998). *Religion*. Cambridge: Polity Press; Esposito, R. (2011). *Immunitas. The Protection and Negation of Life* (Z. Hanafi, Trans.). Cambridge: Polity Press. Byung-Chul Han's account is an exception. He criticizes the contemporary thinking for focusing on the immunology to produce philosophical concepts. See Han, B. C. (2015). *The burnout society*. Stanford University Press. Inger Mutsaers discusses contemporary philosophers and describes the panorama of contemporary political thought in relation to immunology in *Immunological Discourse in Political Philosophy. Immunisation and Its Discontents*. (2016), Routledge.

⁵² For the use of the military metaphors to describe autoimmune diseases in aggressive terms: invasion, defense, and attack, see Sontag, S. (2001). *Illness as metaphor and AIDS and its metaphors*. Macmillan.

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The destructive effects of disease and plague have played an important role in the conceptualization of microbes through their pathogenic character. Yet, efforts to delineate clear boundaries determining the site of disease appearance and its zone of proliferation always failed at some point. Every time, microbial categories remained at the margin of instability which at the same time provided the dynamics for the transformation of categorical schemes. In this respect, Bernard's discernment between internal and external milieu was instrumental. It both endowed the sciences with a functioning research line for the proliferation of meaningful results and recognized the existence of other life conditions that lie beyond human reach at conceptual and organismic level. This distinction complicated the approaches of what might be called "pathological" and brought theoretical frameworks into an approximate assumption of the existence of microbes' "proper life conditions or milieu". A similar movement can be seen within immunological approaches.

At a relatively early stage in the modern study of disease, the picture of the field roughly resembled something like this: microbes were the cause of infectious disease; they were lethal when they were not totally eradicated or sufficiently controlled; control was not easy because the spread of infectious properties may happen quickly and in unexpected ways; and contamination could occur by means of water, air, or contact. As such, the main issue of the time became how to determine the boundaries of the disease in order to estimate the range of contamination which met with the boundaries of the organism for the sake of prevention methods. To prevent disease, the disease-inducing as well as contamination factors had to be isolated and related to the measures in place to prevent the introduction of microbes into the body considered host. The necessity of thinking contamination and prevention together yielded a series of dichotomous terms: invaded and invader, infected and infecting, host and parasite, and finally, self and non-self.

Elie Metchnikoff's Contributions to Immune Theory

The studies of Elie Metchnikoff (1845-1916) played an important role in establishing the discriminations between contrasting terms, examining their interlacing, and isolating a bodily

entity that would later be conceptually labelled “self”. Like Koch, Metchnikoff characterizes the body as a battlefield in which microbial forces and organismic forces enter into a duel in order to gain or defend territory. In each encounter with microbes, an organism activates different evolutionary strategies engraved in embryo:

[w]hen internal factors are powerless to prevent the development of morbidic germs, a disease is set up; when, on the other hand they resist the invasion of the micro-organisms properly, the organism is in a refractory condition and exhibits immunity (Metchnikoff, 1905[1901], pp. 7-8).

Species inherit certain fighting strategies and corresponding elements from other generations as they develop new ones under different circumstances to resist the invasion of other species. To fulfill two tasks at the same time, an organism should comprehend specific inherent mechanisms (by consolidation of functioning strategies for survival) but also have an independent system of “surveillance” and “immediate reaction” able to respond to changing threats in surrounding elements (integration and adjustment of disharmonious elements into a harmonious whole) (Tauber, 1994a, p. 134; p. 462). In this sense, there would have to be a permanent activity of detection capable of distinguishing threatening and non-threatening situations and turning non-threatening situations into an advantage for nutritive purposes. Metchnikoff’s proposition of phagocytes as “eating cells” performs the selective process, both responding to inflammations as a sign of presence of foreign bodies and engulfing and killing them as if they were a prey to be pounced upon (Metchnikoff, 1968). Briefly, with Metchnikoff, an organism was now defined as having an embryo phase and adult phase, ensuring the continuity of existing stability and responsiveness to unexpected situations, establishing organismal activity, and enacting the internal capacities ready at hand in the course of events.

It is interesting to note that Metchnikoff’s findings and arguments have been discredited, or at least, underestimated (Kruif, 1996, p. 191). Not only during Metchnikoff’s lifetime, but for a long time after, his findings would lose favor to Paul Ehrlich’s side-chain theory and arguments on the role of the immune system and its functioning. Ehrlich’s theories were not only thorough in terms of experimental robustness and the developments of the quantitative methods in their explanation of chemical interactions, they were also efficient in the treatment of disease with the drug therapy called “magic bullet” (Jamison, 2014, p. 3). According to Ehrlich’s side chain theory,

a disease consists of chemical reactions based on the attraction and repulsion of toxic and antitoxic matter in which each body accommodates its interactions with an environment. These interactions produce corresponding responses in the body in what Ehrlich called the lock-and-key mechanism and notion of antibody (Tauber, 2017, p. 31). According to this approach, the immune system is born out of the necessity to respond to chemical interactions ubiquitous as a passive condition of nature, which might be explained in terms of causal relations mimicking those interactions under proper scientific conditions. Once the immune system was established as a result of evolutionary development, then it served as a unit of identity that responded to situations through a combinatorial repertory of chemical interactions.

Metchnikoff's research agenda was initially oriented by other kinds of questions. According to Metchnikoff, if evolutionary competition was evident in the struggle amongst species, then there had to be both a continuity in terms of species endurance in a particular lineage and discontinuity in adaptation factors relating to changing environmental circumstances. In this sense, an organism was never found in pre-established harmonious conditions. Rather, an organism always finds itself in unexpected situations into which it needs to adapt and integrate its elements by enacting "a drama within' itself" (p. 27). The normality of an organism is always constituted in precarious conditions, which needs to be reconstructed in "an ever changing set of relationships" in a given environment "at many different levels of engagement".

In other words, for Metchnikoff, the immune identity was not an unchanging unit but a problem. An organism does not have a prescribed structure; it perceives its surrounding elements and responds to them according to necessities of survival so as to activate available organismal materials, tools, and strategies or create new ones when needed. This occurs at all levels, from a single cell to tissues, nerves and organs, until arriving at an organismic integrity that coordinates all layers and levels altogether. Metchnikoff's approach has been accused of vitalism and teleology for its introduction of notions such as intention, purpose, and agency into scientific activity characterized by impartiality, objectivity, and opposition to speculation. As Tauber has suggested, maybe Metchnikoff and Ehrlich's two divergent positions in immunology need to be considered as propositions for two different research agendas, each having a certain relevancy to our understanding of immune phenomena (p. 33). Tauber's point will be made clearer with Frank

Macfarlane Burnet's more complete theory of the immune self as well as the more recent ecological approaches in immunology.

Towards a Scientific Notion of Immune Self: Frank Macfarlane Burnet

Contributions to the study of infectious diseases reached a peak with Burnet's clear demarcation of self and non-self when the immunological paradigm manifested in all its divergent and convergent lines. Burnet's clonal selection theory conjoined different aspects of immunology, from embryology, chemistry, and evolutionary biology to developmental biology and genetics, to produce a thoroughly biological conception of the immune self. With Metchnikoff and Ehrlich, we saw two tendencies in the study of immunological relationships. When the former didn't hesitate to appeal to avowable philosophical speculations, but always in contact with the findings of evolutionary biology, the latter remained decisively on the positivist side of immunological questions by referencing medical cases. With Burnet, these two tendencies spin together in creative ways.

In the context of Burnet's theory, the immunological notion of self or selfhood⁵³ arises from the very basic fact that an organism needs nutrition to survive but that each nutritive act might be a threat to the integrity of the body (Burnet, 1940, pp. 36–37; also quoted by Tauber, 2017, p. 43). Following Metchnikoff's analysis of predatory amoeba engulfing and digesting its prey—the bacterium, Burnet questions an organism's capacity to delineate its bodily boundaries and activities. Burnet argues that, if the amoeba didn't have a separate existence from the bacterium, there wouldn't be any prey/predator relationship amongst them. The amoeba would lack organismic facilities needed to help it detect, define, engulf, and digest the bacterium. According to this logic each organism has a chemical disposition of “self-persisting units” that enable it to recognize the characteristics of its own activities. In the same way, it also has sufficient chemical

⁵³ Instead of approaching the idea of selfhood as imported from the cultural and historical milieu into the scientific context, the immune self is examined as an idiom that grew its roots within science to become an immanent component of immunology (for the first idea, see Tauber, 1994a; for the second, see Tauber, 2016).

sensibility for detecting activities that do not belong to it. In other words, an organism is capable of distinguishing between self and non-self, the circumscribed borders of identity, and its dichotomous correlate the environment of digestible substances (Tauber, 2017, pp. 45-47). An organism's ability to differentiate itself, its environment, and the presence of other living beings amounts to the possession of a sense of agency based on an autonomous organismic identity and range of performable activities. For Burnet, the situation of an organism was much more complicated than this. The agential character of an organism is also inward-oriented in the sense that its constituents, even when including certain substances treated as pathogenic when encountered in other species, are ignored or tolerated in diverse conditions. For Burnet, the immune self was problematic even though it had a firm identity and circumscribed borders.

First, the complexity of the boundaries marking the limits of self and non-self generate situations in which self and non-self components overlap in their respective relationship and the immune system "perceives" certain components as foreign thus causing auto-immune diseases. For Burnet, the fact that components of self could be considered as components of non-self by the general identity of an organism shows that the components always remain in a grey zone where they take their final determination according to circumstances. Secondly, an organism finds itself in ambiguous situations as observed by Burnet in cases where an organism took on an unexpected shape, produced features that belonged to other organisms, or took on features not definable in terms of existing organisms. Burnet conceives these cases as instances of nature's chimeric activity and the alloy of self and other (Burnet, 1962) (especially observed through mutations at embryological level). This complication of self and non-self places the role of the immune system in a continuum. In this continuum, a repertory of immune responses unfolds within a range of acts of tolerance and destruction with respect to the elements in an environment and organism's perceptual equipment. According to this approach, neither is each microorganism considered a non-self, hostile entity nor does each self component function for the benefit of the organism. In this sense, the separating line between infection and nutrition, disease and health, and destruction and tolerance is never absolute. Burnet's conception of the immune self thus approaches an ecological outlook in which self and other coexist in a vast territory where living beings interact with each other in various ways.

Ecology in Sciences (and Beyond)

Leeuwenhoek's discovery of animalcules opened a new realm for both scientific scrutiny and philosophical reflection. Leeuwenhoek had already attested that animalcules were the source of infectious diseases. Since, despite the recognition of their utility in certain natural processes such as fermentation, they have been considered mainly through their pathogenic features and studied from the perspective of their disease-causing characteristics. In the conceptualization of microbes, the immunological paradigm may have already started with Pasteur and Koch. Pasteur and Koch managed to isolate disease-inducing factors, suggest relevant cures, and finally, develop preventive measures. But the development of the notion of an immune self began with Metchnikoff's understanding of an organism's self-defense mechanisms to find its real schema with Burnet.

When microbes were defined as organisms equipped with malicious effects posing a threat to the integrity of the animal body, this placed microbes in the context of the prey/predator relationship. Accordingly, it then followed that the body had to have certain barriers to either violate or not following encounters with environmental factors considered useful (nutrition) or harmful (infection). Burnet's notion of immune self functioned in two cyclical directions. One direction was the dilation of the organism towards its exterior conditions so as to put itself in jeopardy and the other the contraction towards secure borders of identity in dynamic and elusive fashion. According to Burnet, the process was always in favor of the latter, yet demonstrated elasticity for tolerating certain aspects of the former, casting some doubt on the idea of definite borders of self. For Burnet, organisms possessed full-fledged mechanisms to remain secure and persist in various conditions. However, those mechanisms were incessantly permeated by pressure from external factors never totally foreseeable. Ecological perspectives will emphasize this second point beyond harm/benefit, risk/preservation dualities. These perspectives will shed light on immunological constraints of the self/non-self binary, bringing forth a different understanding of nature and environment.

The immunological paradigm's main focus was on the discrimination between self and non-self for it was the *sine qua non* condition for an organism's ability to protect itself against pathogens. Nevertheless, in Burnet's account, an organismic identity has to adapt itself to dynamic, inconstant, and unstable conditions. Since pathogens come from an indeterminate source,

organisms thus encounter both pathogenic and non-pathogenic substances (Tauber, 2008a, p. 272). It was soon understood that the responses plying between an internal structure of self and external environment were reciprocally dynamic. After Burnet, Niels Jerne would challenge the self/non-self distinction by carrying into it the unified self. According to Jerne (1974, 1985), the self organizes itself by the interconnectedness of various elements constituting a vastly complex interlocking system of joined antibody and lymphocyte elements. The “normal” state of this network is stability within the ongoing self-recognizing activity (Tauber, 2008b, p. 226). This network activity responds to the disturbances arising from unforeseen events that provoke a cascade of events in an organism in its effort to bring itself into a new stable state.

As it may be evident, Jerne’s theory was inspired by the cybernetic notion of feedback loops. Each time, the self would coordinate itself in response to perturbations now adapted to the immune responsiveness’ triggering process as an “inner driven, self-organizational model” (p. 226). In this line of thinking, but with a different focus and proposition, in 1994 Polly Matzinger proposed understanding immune phenomena through a “danger model” but this time in reference to the environment rather than the self/non-self model (Matzinger, 1994; also quoted in Bates, 2015, p. 27). The notion of an immune system may have been first understood as the response to dangers by detection and protection mechanisms, but with Matzinger, communication with the environment now came to the fore, singled out as negative or positive in the manner of cybernetic accounts. Rather than refusing the self/other duality, Matzinger complemented it with an “ecological sensibility”. This sensibility was activated in the “context” of the interchanges between an organism and its environment where the elements of immune system, lymphocytes, antigen-presenting cells, and tissues cooperate with each other so as to produce a response (Tauber, 1999, p. 468).

Here, it is important to mention another influential development in immunology within the ecological paradigm. Endosymbiosis or symbiogenesis theory was first proposed by Russian botanist Konstantin Mereschkowski in 1905 and 1910 and articulated and demonstrated in 1967 by American biologist Lynn Margulis. According to this theory, microorganisms are much more inclined to collaborate with animals and plants rather than destroy them; they constitute a crucial part of an organism’s functioning (Margulis, 1997). With contributions from other theoretical biologists such as Dorion Sagan and James Lovelock, the evolutionary processes would be reread

from the perspective of microbes' transversal reproductive processes (Lovelock, 1987; Margulis and Sagan, 1997)⁵⁴. With endosymbiosis, this reversal would now place human beings as partakers of a vaster molecular ecology of lowest cellular bodies⁵⁵. As Keith Ansell Pearson has pointedly stated: “[a]n essential part of the history of symbiosis will be to formulate germs not simply as “disease-causing” but as “life-giving” entities” (Pearson, 1997, p. 134). Without the presence of symbiotic microbes, the metabolism of an organism would be disrupted. For instance, microbes within the gut take an active role in the specification and organization of lymphoid tissue (Tauber, 2012b, p. 102) crucial for the whole immune system.

With the introduction of ecology, contextuality, and symbiosis into immune theory, ecological perspectives would gain more and more currency. At the conjunction of immunology and ecology, an approximate picture of contemporary immunological discourse resembles something like this: the immune system is responsible for perceiving an environment and enacting an appropriate response; it is distended for danger and detected and qualified by means of a repertory (“library”) of pathogenic substrates; however, sometimes the immune system remains silent in the presence of the same substances under certain circumstances (“they are tolerated”); even though its main task is to protect the self against pathogens, it has a certain “ecological sensibility”, omnipresently functioning by scanning the environment for all kinds of situations—perilous or innocuous; thus, the dynamic structure of the immune system is intricately bound to the complexity of an environment. We can add to this simplified picture that immune reactivity doesn't concern only the tolerance of the presence of certain “foreign” elements, and accordingly,

⁵⁴ Lovelock et al.'s thesis explains the formation of eukaryotes and multicellular organisms in terms of cooperation and fusion between different organisms, a thesis consolidated by results found in different related fields. For significant similarities in terms of informational processes (replication, transcription, and translation) with eukaryotes, see Rivera et al., 1998; Thiery et al., 2012; for horizontal gene transfer within and between organisms, see Woese & Goldenfeld, 2009; Goldenfeld & Woese, 2011; for the extraordinary importance of microbial diversity, see Eme and Doolittle, 2015; Hug et al., 2016; Rinke et al., 2013; Yarza et al., 2014.

⁵⁵ This approach finds its most comprehensive version in the Gaia hypothesis (Lovelock, 1972). According to this hypothesis, the biosphere defined as the totality of a community of cells “is one interdependent entity” (Margulis, 1995). It's capacity to regulate itself depends on the metabolic processes of microorganism (Margulis & Lovelock, 1974). Microorganisms interact with inorganic elements on Earth, which form a self-regulating, complex system. Life perpetuates on Earth as a result of a complex interacting system that maintains the climatic and biogeochemical conditions on Earth in homeostasis.

certain microbes, but also the cooperative relationships that occur both within the organism and the environment⁵⁶. Thus, the ecological approach will fully come into view with its focus on complex interrelations amongst all realms of life, inorganic or organic, including beneficial or hostile contacts.

In 1866, Ernst Haeckel used the term ecology as the study of “the interrelationships of living beings among themselves”. Haeckel conceived ecology in terms of physiological processes and was aligned with the research agenda of physiology of his time on the matter of organism and environment relationship (McIntosh, 1985). Yet, in the same way that the immune self was each time explained by well-defined boundaries, even though violable, not insuppressible as far as an organism was alive, so too was the physiologist understanding of ecology being shaped by a self-regulating, stable, and self-contained conception of the environment. But, relationships among species and the environment were much more complicated than this. Understanding them required a more system-based approach in order to include the findings of different disciplines—the “biological, physical, and social science aspects of man-in-nature interdependence” (McIntosh, 1985, p. 202), as well as mathematic models for measurement of energy flow through a system (Tauber, 2008b, p. 230). In the ecological approach, a microbe, for instance, is not primarily defined as the main cause of an infectious disease, in other words, by its pathogenic character. Rather, it is defined as part of a larger dynamic in which different species interact with each other, with environmental factors such as nutrient cycling, biogeochemical cycles, the flux of energy and matter, and many other features of scientific, historical, economic, and intrinsic value which intervene in the emergence of their behavior at both individual and population level as they intermingle.

A microbe is thus defined at the intersection of different conceptual organizations: ecological, cognitive, and systems biology. With the ecological approach, microbes now have a regulatory perceptual mechanism that sort out external source stimuli and feed-back and -forward

⁵⁶ Cooperative relationships, such as inactivity against symbionts, coexist in all organisms. In humans, the best studied case is the vitamin K producing bacteria of the intestine (Ivanov, Diehl, and Littman: 2006) that provide the cofactor required for blood coagulation and energy metabolism.

simultaneously resonating interlaced levels⁵⁷. In this way, one of the main points of Metchnikoff's approach to microbial life is reaffirmed: the organismic identity that would take its ultimate form under the rubric of Burnet's immune self is not a fixed entity. Challenged all the time by diverse encounters, it appears as a problem. With the ecological perspective, the emphasis shifted from an organism's identity structure to all sorts of environmental factors that include a variety of defensive or cooperative relationships. Accordingly, in the conceptual apparatus of immunology, the problem was not resolved with identity but permeated into the various encounters framed by different disciplines in an ecological orientation.

Ecology, despite its close contact with physiology in its nascent state, would soon announce its independence. Refusing to remain a subdivision of biology, it would position itself as a separate field drawing its own research agenda. Ecology's strong rising would influence diverse life science fields as well as intellectual circles in search of more interdisciplinary and less rigid approaches to understanding natural and cultural phenomena. Thereby, many sorts of ecologies proliferated: ecology of mind (Bateson, 1972), ecology of media (McLuhan, 1964; Postman, 1987; Fuller, 2005), ecology of perception (Gibson, 1986), ecology of communication (Luhmann, 1989), ecology of recognition (Clark & Chalmers, 1998), ecology of practices (Stengers, 2005), ecology of power (Massumi, 2009), and ecology of attention (Citton, 2017)⁵⁸ just to name a few. In another vein, this shift towards ecological thinking, by also merging with prevalent contemporary themes such as self and other, agency, subjectivity, biopolitics, ethics, etc. brought into relief a certain effort to think the biological from a more global perspective and in non-biological terms. *Eros* embodies both forms. Produced by virtue of biological possibilities, discursive or practical, *Eros* opens those possibilities to "other" modes of relationality by dissolving the dichotomous relationship between self and non-self with a wider ecological sensibility.

An Expanded Field of Immunology with Donna Haraway

⁵⁷ For the impact of cybernetic accounts on immunology and birth of ecological approaches, see "Elling Ulvestad's *Defending Life*: 2007; reviewed by Tauber (2008).

⁵⁸ For a detailed archaeology of the rise of ecological approaches, see Hörl, E. (2017). Introduction to general ecology. *General Ecology: The New Ecological Paradigm*, 1.

There is no doubt that *Candida* presents pathogenic characteristics, creates irritation, and in some situations, might even lead to death. More generally, the medical and pharmaceutical industry mobilizes their means to determine specific causes of symptoms to propose solutions. According to their “natural” presuppositions and historical inclinations, in the case of thrush irritation, a normative framework which posits the body as a consistent unity is extrapolated in practices and institutions so as to repair the transgressed boundaries of an organism. But there is yet another possible perspective to our relationship with the same microorganism, one not essentially determined by pathogenicity. Recent findings in microbiology and other related fields show that we share our body with many different kinds of microorganisms and the landscape of the body constantly changes according to how we live and interact with our environment. Not all of our possible paths of action in our encounters with microorganisms are simply in the direction of their destruction. They vary from one situation to another according to reciprocal adaptations of different kind of living beings sharing the same fauna.

To understand the convergence between immunological discourses mobilizing the self/non-self dichotomy and the relative parceling of cultural space into the friend/foe opposition an early Haraway text (1991) looks at the possibilities of producing alternative discourses (pp. 203-31). In *The Biopolitics of Postmodern Bodies: Constitutions of Self in Immune System Discourse*, Haraway finds one such example in Octavia Butler’s science fiction novel *Clay’s Ark* (1984). Similarly, I argue that, by presenting contrasting immunology perspectives in the art gallery environment through the experience of eating bread leavened with *Candida*, *Eros* is a project that uniquely contributes to the proliferation of alternative discourses.

* * *

According to Haraway, the image of the immune system is “an elaborate icon for principal systems of symbolic and material “‘difference’ in late capitalism” (1991, p. 204). It reflects ideas emblematic of the 20th century: identity and selfhood. Haraway’s main argument is that a shift in the discursive organization of the immune system attests to the late capitalist reorganization of Western politics around recognition and misrecognition of self and other. In this argument, what the natural sciences in the context of immunology reveal is not the inherent meanings and

properties of bodies or organisms. Rather, for Haraway, they reveal that they are produced or constructed as a result of the organization and (re)mobilization of discourses, “enact[ing] condensed contestations for meanings and practices” (p. 204). In this sense, scientific discourse—as an intermingling of “artefacts, images, architectures, social forms, and technologies”, brings forth a certain determination of the organism, not absolute but consisting of “constructs of a world-changing kind” (p. 204). Biological bodies, situated at the intersection of myth, laboratory practices, and clinical experiences as “material-semiotic generative nodes” thus emerge:

at the intersection of biological research, writing, and publishing; medical and other business practices; cultural productions of all kinds, including available metaphors and narratives; and technology, such as the visualization technologies. (Haraway, 1995, p. 221)

The understanding of immune system received its share of interest within the reorganization of biomedical discourses. Formerly based around the depiction of the self/other duality with an appeal to military metaphors, the depiction of the immune system had taken on a colonial imaginary. In this imaginary, the hierarchically organized elements produced a strategically organized response in the case of infectious diseases threatening the supposed pureness of an animal body. With the reorganization of biomedical discourses, this image now relied on “a very different set of technologies and practices, which have destabilized the symbolic privilege of the hierarchical, localized, organic body” (p. 211).

The colonial imaginary of the immune system relies on the ‘otherness’ of microbes symmetrically defined with respect to the organismic self through which species properties are taxonomically ascribed. As a result, an infectious disease is described as “a process of misrecognition or transgression of the boundaries of a strategic assemblage called self” (p. 211). However, this discourse lost its basis and credibility for it could no longer map the normalized functions and hierarchical elements in contrast to ever-changing environmental dynamics. In each immune system response to external conditions, there was a “difference” involved in the action paths triggered in the body with respect to an already presumed schemata of reactive immune patterns resonating at organismic and environmental level. The inauguration of difference by immune theory was guided by a principle of interaction and the network-like organization among various elements capable of some autonomy. After revisiting contemporary immune theories,

Haraway concluded that more “liberatory” immune theory approaches that have come into the fore would feed different cultural representations of the immune self in different ways.

For Haraway, antecedent immune theories’ insufficiency and invalidity in explaining infectious diseases as well as immune system functioning derive from various scientific, social, and political factors. Haraway argues that each new theory offers a chance to understand the complex interlacement of self and other in the various cultural and political production of bodies. To do so, she proposes to examine contemporary representations, from visualization practices to popular narratives and science fiction. Despite the constant return of defense and invasion and war and colonialism semantics in scientific discourses and popular representations, for Haraway, there may also be alternative discourses able to focus on “shared specificities” of “the semi-permeable self able to engage with others (human and non-human, inner and outer)” (p. 225). With Butler, Haraway finds such a case in science-fiction literature (pp. 225-30).

Butler questions the boundaries of humanity and limits of selfhood and individuality by creating challenging situations for humans. In *Clay’s Ark* (1984), Earth is invaded by extra-terrestrial disease carried in the bodies of returned spacemen. The infected bodies propagate certain beast-like characteristics, such as a quadruped form to their offspring, putting human beings into the position of renegotiating what counts as human. When the disease reaches global level, all the boundaries between inner and outer space, self and other, human and non-human, and native and foreign blur. This forces people to invent new forms of communication in an indefinite and unpredictable future imminently at the edge of destruction, adumbrating Butler’s pessimistic tone. Haraway conceives this Butlerian account as a figuration of non-human forces located in the compelling case of an epidemic. At the same time, in the conditions of a literary space, the dichotomy between real and fiction collapse over an oscillating hybridity. What comes into expression is an intermingling trafficking “across [the] specific cultural, biotechnical, and political boundaries that separate and link animal, human, and machine in a contemporary global world where survival is at stake” (Haraway, 1991, p. 229).

Eros presents a similar case, this time from the perspective of an art practice engaging directly with scientific activity, especially as crystallized in the biological laboratory. Bates plays and mingles with different materials and meanings in order to create a situation where gallery

visitors might engage with *Candida* in an affective basis. She doesn't contend with existing scientific discourses on *Candida*, neither appropriating military metaphors or colonialist discourses but looks for the possibility of alternative facts.

Taking Care of Microorganisms: Science and Art ScienceandArt scienceandart

Existing scientific discourses help formulate a research question, meet with scientific methods, protocols, and techniques that structure the experimental setting to yield outcomes. Within this scientific framework and in the case of pathogenic beings such as *Candida*, one must also “control the environment” and obey “institutional regulations” with necessary risk management procedures in the experimental setting. The process line of scientific knowledge production starts with an existing, established research setting and ends with the production of relevant results. It necessarily eliminates relatively extrinsic conditions as irrelevant, focusing only on particular aspects of a research context. In this way, the process bypasses potential lines of thinking and making that might come along with the “side”-effects of the same process put aside from the point of view of the scientific framework in question. Notwithstanding, sciences keep producing meaningful results with the mobilization of protocols, methods, and techniques, which aims to lay bare an unexpected response from the studied organism. In return, this serves as the motor of scientific progress breeding curiosities for scientists as well as the wider public.

The sciences have increasingly become more oriented towards relationalist perspectives. A shift from the discredited approaches based on species classification to more holistic approaches doesn't mean, however, that the conception of microbe based on species properties has entirely disappeared. What changes in this shift is that a microbe is no longer defined by its properties isolated in a biological laboratory in compliance with categorical necessities. A tendency in scientific research arises in the direction of defining microbe properties in terms of the relationship with other living beings and surrounding environment. From pathological approaches to ecological ones, this paradigmatic change opens paths for the examination of unexpected entanglements between microorganismic qualities and the human body. Microbe-artworks are situated at the junction of research and creation, being widely influenced by the ecological approaches.

Today, in order to control or eradicate microbes, we are more or less prepared for their pathogenicity but don't know quite yet what to do with them in non-pathological contexts. The microorganism *Candida*, commonly known as the agent of thrush in human cultures, shows amazing abilities that cannot be encapsulated solely in the context of pathogenicity. Highly responsive to its environment, it easily shifts form according to the necessity of life conditions, and even develops different reproductive strategies. Conversely, it may cause great irritation, discomfort, and even life-threatening situations for human beings because of its pathogenic character. Women, especially, have a specific relationship with *Candida* since the cavities of the human body provide the optimum conditions for its survival; the vaginal tract is one of its preferential sites.

Eros plays with the ambivalence of human sovereignty over microorganisms. Bates places emphasis on the co-evolution of human species with this family of microorganism to explore the complexity of this relationship, not indifferent to the progress of sciences and highly sensitive to features of human cultures. When it comes to the use of microorganisms for instrumental ends, for instance in industry and agriculture or to develop the means for destroying them, science and technology are quite efficiently mobilized. What happens, however, when a microorganism known as thrush and mostly identified with the vagina is implemented in an artistic setting for the sake of aesthetic and intellectual exploration of our relationship with it? Bates transforms the art gallery into an experimental site of investigation by offering visitors bread leavened with *Candida*. Eating the bread can make people think about *candida*, as well as cause discomfort. Although the bread doesn't include any pathogenic properties or possess any visual, olfactory, tactile, or auditory cues, it creates in some visitors a feeling of disgust and revulsion. We are in contact with microorganisms all the time. We live with them. Yet, certain encounters create conflicting feelings in us, putting us in an unsettling situation.

Eros problematizes the immunological paradigm of microbes based on the invader-invaded dichotomy which in the end, gives rise to alternative conceptualizations. Bates's work enacts this transformation in the specific setting of the art gallery by creating a problematic situation in which the effects of the immunological conception of microbe are still felt by visitors. Fascinated by *Candida*'s extraordinary response-abilities, Bates' relationship with it exceeds a simple relationship of utility and turns into a matter of love, sympathy, and care. *Candida* may be used as

a leavening agent for making bread with no perceptible difference in appearance or taste. Yet, when Bates offers it to gallery visitors, not only does the bread made with *Candida* but also the “normal” bread offered alongside it produce feelings of disgust and revulsions in some of the gallery visitors. It is as if, for some of the visitors, *both* the breads still contain pathogenic properties or evoke the vagina—the most culturally known site of thrush. Bates’ project questions precisely this contradiction by means of the gallery environment she creates.

Aesthetics of Care

Eros depends on a very simple idea: the livingness of *Candida* matters. Accentuating this aspect of livingness outside the pathogenic context and scientific framework might be problematic. Meanwhile, to consider it merely thrush would be a very limited expression of its capacities and life conditions. As a yeast fungus, *Candida* is no different than other yeasts used as leavening agents for bread. Seeing and experiencing *Candida* in different ways than thrush might arouse interest and raise awareness about the complicated relationships between living beings that trigger love and sympathy, disgust and revulsion.

In its production, Bates’ art project undoubtedly bears on certain scientific discourses and procedures. But as she states, there is even “more to do with [*Candida*], things that you wouldn’t do in the scientific framework”⁵⁹. The project distinguishes itself from the science’s semantic range in its reorganization of the materialities inherent to the scientific domain and recomposes them so as to render the complicated relationships between different material-semiotic systems feelable. The role of the sciences is undeniable here. Yet, even though taxonomic topographies present an angle of entry for the composition of the work, what really matters is learning from the sciences on how to deal with *Candida*, how to take care of them in order to keep them alive. This supposes a certain sensitivity towards the life conditions of *Candida* as explained by sciences, for keeping them alive by means of scientific possibilities. In other words, how to approach them with a sense of care and following certain scientific protocols that mimic the mechanisms sustaining

⁵⁹ Tarsh Bates, personal interview with the artist, Berlin, November 23, 2017.

the liveliness of *Candida*. A crucial point of Bates' project, however, is to push the materials to make something else. In this sense, *Eros* is doubly problematic.

Firstly, Bates' project is a question of learning from the sciences, from the laboratory practices by borrowing protocols related to the sustenance of *Candida*'s life. For this, one needs to suppress the cues that makes *Candida* a pathological entity to make it similar to leavening agents. Secondly, all the scientific methods, procedures and techniques put into use open into a non-scientific environment. In the art gallery, our relationship with microorganisms will find a singular cultural, affective, symbolic, and material expression, proliferating indeterminate ("unsettling") feelings in gallery visitors. The fascination, love, and care for *Candida* that is the essential motivator of Bates' project will resonate in an environmental sensibility that undermines human exceptionalism. Contrarily, in some visitors, the same gesture will also activate feelings of disgust and revulsion as if bread leavened with *Candida* still contains the pathological properties that cause thrush, evocating its cultural and symbolical receptions. Nevertheless, the work doesn't take a final stance on the issue but maintains its problematic status. When Bates sometimes refers to her artistic practice as "transient" or "processual" art⁶⁰, this is because the spatiotemporal coordinates of her work give rise to a consistency designated ecologically in a wider sense and which may only be experienced during the exhibition. The work's "ecology" brings together several elements into a dynamic so that, despite the ephemerality of experience, the work sustains its consistency in the contact zones of species, discourses, materialities, and meanings, again with reference to Haraway (2003, 2008). Now, to understand the problematic structure of the work, it is crucial to examine how these two aspects, consistency and transience, are articulated with each other.

Eros is an artistic project but one realized through the active collaboration with life sciences and laboratory practices. Even though there are specific reasons for appealing to sciences and benefitting from its processes, here, science is only meaningful in relationship with other tools, techniques, and meanings:

I use science as a tool among other tools. I'm a scavenger. I would take stuff which is useful, and science is useful"⁶¹.

⁶⁰ Personal communication.

⁶¹ Personal communication.

Like everything, science is not neutral nor devoid of values. Science delineates a sphere of objectivity wherein the production of meaningful results can be rendered possible. But the act of this sphere's delineation depends on certain premises and presuppositions that operate as world-building factors. To explain the sciences' subjection to change and its implication with social and political orders, Bates gives the example of evolutionary theory:

If you base evolutionary theory on survival of the fittest, then you get a very competitive order of the world. You see the competition everywhere, which has happened in the 20th century, it became the order of nature. It means that you get this loop: the nature is competitive; therefore, competition is natural⁶².

The birth of sub-fields in life sciences and the proliferation of new discourses complicated the interactions between social, political, and biological orders. In the case of *Candida*, we have seen to what extent a pathological understanding of microorganisms and its equivalent variant in immunological discourses has shaped their various approaches. Bates notes the prominence of research orientations based on the negative effects of *Candida*:

There was this focus very much on hospital mortality in research papers as opposed to long term thrush infections in women, that gives rises to a research agenda that looks for 'the most intensive factors'⁶³.

Today, life sciences are certainly not only shaped by one type of discourse. They are shaped by different research agendas realized in different experimental settings in combination with different discourses. As a result, they proliferate new questions and experimental conditions. In terms of our relationship with microorganisms, Lynn Margulis's contributions are especially crucial in paving the way for alternative discourses and research agendas. As Bates underlines, "what Margulis and others did was actually this, looking at the cooperation, cohabitation between living beings. These things are not mere exceptions"⁶⁴. But whenever it is a question of treating microorganisms in laboratory conditions, the elimination of the complexity of factors becomes

⁶² Personal communication.

⁶³ Personal communication.

⁶⁴ Personal communication.

necessary, and the sole manageable method appears as the purification, which will give rise to a certain Pasteurization ethics⁶⁵.

However, ecological discourses about nature and microorganisms and the contributions of trans- interdisciplinary studies in emerging fields of feminist science studies, art and science research, critical science and technology studies, etc. have brought about the possibility of a different kinds of ethics. *Eros* aligns with contemporary concerns of thinking ethics not in cognitive (moral) and normative terms but in more relational and processual ways. In this sense, it is not difficult to see Haraway's influence in the work. Found not only in the artistic practice of a theoretical biological approach, this influence can also be seen in the work's dynamic form of becoming with non-human forces.

Haraway's analysis of immune theory sheds light on how different material semiotic systems are complexly articulated with each other in the relationship between science and politics, insisting on alternative paths and actions. Bates' work expresses itself in this mode. Rather than the immunological discourse's reliance on military descriptors of the relationship between different organisms, Haraway's conceptualization dwells in more affirmative relational modes. The concepts of contact zones, response-ability, or intra-action that will come to permeate Haraway's work become operational in *Eros*.

One aspect of *Eros* can be said to be the production of alternative facts derived from the "natureculture" entanglements traversing the field of immunology. Another aspect articulates the affective and symbolical gestures of love, care, disgust, and revulsion that meet with the complexity of a field that might be called *culturenature*. The *culturenature* field weaves the interrelationships between the tensional forces from and through the other side of the continuum. These two sides come together in the performance of eating a bread leavened with *Candida*. The

⁶⁵ See Bruno Latour (1993), *The Pasteurisation of France*, Harvard University Press. In contradistinction to such an ethics, a "microbiopolitics" of the living beings (personal communication with Tarsh Bates) can be asserted. Heather Paxson calls to attention this parallelism or tension of how to live with microorganisms with how humans ought to live one another. Microbiopolitics involves the circulation of meaning in local networks, outside dominant regimes of biopolitics that standardize and centralize how life is managed. The philosophical attention to microbes might lead to a better understanding the influence of microbes on human health, evolution, and the interactions among living beings on different scales. See Paxson, H. (2012). *The life of cheese: Crafting food and value in America*. Univ of California Press.

performance functions in two registers that reciprocally feed off each other. It raises awareness on the complexity of microorganism life as irreducible to pathogenic aspects, while at the same time producing conflictual feelings for some visitors. In this second register, traces of the pathogenic conception of microorganism are not only reproduced in terms of intellectual appropriation but are felt in the lived experience of the visitors under the guise of sympathy, love, disgust, and revulsion. As a result, when it calls forth cultural meanings, the work serves as a point of entry for other forms of intellectual inquiry (*scavenging*).

In this sense, Bates' work is not destined merely to one specific line of experience but opens to multiple lines of contact zones. Thus, the third point reveals yet another Harawayian inspiration. "Breaking bread" with the accompanying "critters" doesn't concern only the human realm and its sovereign mode, which has absolute control over other living beings. Rather, its symbolic, affective gestures incite a multiplicity of response-abilities in contact zones with "microorganismic audiences", positing friendship, care, and solidarity as the non-human forces. This will also provide some hints about Bates' general task of thinking and creating a relational ethics with respect to the natureculture continuum and our response-abilities.

The Ethical-Aesthetical Ecologies of *The Unsettling Eros of Contact Zones*

The place where discourse and practice come together is also the place where non-discursive and unexpected actions by the supposed subject of experience manifest themselves. In the case of *Candida*, and especially considering our long-term relationship with it as thrush, this appears under the form of resistance:

Candida is fascinating. It can build on human tissue, latex, silicon, you name it... That's why it resists to treatment, why it causes health problems. It resists to our attempts of controlling it. Disciplining bodies comes with the resistance, a very Foucauldian idea⁶⁶.

Its resistance to treatment doesn't simply connote an inability to understand *Candida*'s behaviors under laboratory conditions or the lack of appropriate methodological tools. It points to *Candida*'s sensitivity to experimental settings which frame its behavior in different ways. In other words,

⁶⁶ Personal communication.

Candida responds to experimental conditions in changing ways. In fact, scientific activity depends on these conditions for reproducing the variables of *Candida*'s abilities responding to different settings. The interaction between *Candida* abilities and scientific setting is never a one-way street. Haraway quotes from Pemberton: "We cannot understand how scientists discipline their experimental organisms without understanding how these organisms also discipline scientists, forcing them to care" (2003, p. 26). As much as the experimental setting is able to pose the appropriate conditions for producing and validating a hypothesis, it brings into light certain patterns of reactions of *Candida* "behaviors". Previously unknown, these behaviors are now rendered expressible in quantitative terms as a result of the creation of an interactional field of the presupposed variables. In this way, how *Candida* behaves, what it *does* in different conditions accumulates in the *Candida* knowledge:

What *candida* does and how it responds to what we are doing is shaped by the experimental setting. Its environmental conditions change the reproductive strategies. It has six reproductive strategies and nine different body forms that changes into survival in its environment, in different niches in our body. We call all of them in the same ways because of the genetics of it. Because we have a habit of it⁶⁷.

We don't only have a habit of explaining *Candida*'s different traits with respect to the self-similarities that remain unchanged from one experimental setting to another. We also hold the view that the self-similarities (points of categorial culminations) reflect the habitual patterns of *Candida*'s behaviors. Each time this loop between *Candida*'s behavior and the experimental setting is reorganized by some slight variations, what appear is a "constellation", as Haraway calls it in *The Companion Species Manifesto: Dogs, People, and Significant Others* (2003). A *Candida*-constellation functions as both a category-displacing entity and life-giving agent. At the intersection of technologies, cultural significations, representations, discourses and objects, this constellation is arranged and rearranged by processes, investments, bodies, histories, languages in opposition to the limited model of immunity based on recognition or misrecognition of self and other.

In cases where *Candida* doesn't manifest itself in symptoms like irritation leading to the awareness of the presence of "thrush", *Candida* continues to share the same ecosystem within the

⁶⁷ Personal communication.

body, entering into a variety of interactions with it. *Candida* has a certain performativity in the body that escapes the scientific gaze, which only considers the determination of symptoms and categorical productions that will function as the basis of the treatment. But in-between, *Candida* continues to take various shape and interact with other elements in the ‘human’ ecosystem, as well as with other microorganisms, or environmental factors:

That performativity of it in our bodies I fell in love with it... This is really interesting. Microorganisms are completely social. They communicate⁶⁸.

Candida shares the same status with what Haraway calls the companion species. In Haraway’s conception, this is the accompaniment of species within different dimensions of reality that don’t have a preordained endpoint, escaping from limitations of predestined codes. Instead, companion species perform their qualities in diverse ethico-aesthetical dynamics as active partners in a longstanding collaboration (2008, p. 165). How these dynamics unfold in specific settings is conditioned by how the situated mutual pre-understandings are channelized towards communication and action. This puts ethical issues at the heart of our engagement with microorganisms:

You can’t get rid of it [*Candida*] totally. It always pops up. How do you live with that? It’s not just good or bad, it’s not we just treat it and it’s gone. We have to learn how to manage it, balance it. We have that sort of space which is unique in microbiome organisms, we learn by this discovery of microbiome. We have such a tradition of human autonomy and exceptionalism. The idea of plurality of mass is conceptually interesting. How do you translate it into more aesthetical and conceptual terms, how do you implement that in terms of a way of living ⁶⁹?

In this regard, the motivating force behind *Eros* is the desire to explore and perform *Candida*’s ethical-aesthetical possibilities. *Candida*’s ethical-aesthetical possibilities are apprehended through the scientific framework (including not only discourses but also methods, practices, and categorical schemes) as a starting point, but are left outside the scientific context simply because they remain out of the scope of its activity or are just not interesting from a scientific point of view:

⁶⁸ Personal communication.

⁶⁹ Personal communication.

I'm more interested in the proliferation, the diversity of the possibilities, the performances⁷⁰.

Performing the possibilities is only possible by “pushing the materials... to the limits of what they can do”. In the context of *Eros*, this is a question of learning how to grow *Candida* under different conditions than the petri dish. The basic idea behind the project is to grow *Candida* as a leavening agent, create a convivial ambiance in the art gallery, and offer to the gallery visitors bread leavened with *Candida* alongside bread leavened with “normal” yeast. Both the breads will be accompanied with humus and cheese. Here, Bates is in conversation with Haraway’s doubt about mediated gene transfers between members of the same biological species that would make them suspicious “messmates” at the table. Bates invites *Candida* to the table as a messmate to “break bread with”, setting up the problematic character of the situation in the art gallery. Now, what is at stake is “which companion species will, and should, live and die, and how” (Haraway, 2003, p. 18).

In this way, the art gallery hosts diverse types of relationships in which different performativities come together under the “*Candida* effect”. Undoubtedly, a certain type of sympathy or love for *Candida*—the inductive force of *Eros*, provides the preliminary conditions for aesthetic engagement with the work. But the activation of that force is not separate from other forces sown in the field, which resonate for the gallery visitors in different ways. Aesthetics of care come to the fore in their groping and assembling of the forces that will come to create the convivial texture of experientiality in the gallery site. However, this at the same time creates a slightly disturbing situation where our existing way of relating to *Candida* as thrush becomes problematic:

If you are doing an aesthetic of care, you need these spaces of difference, not necessarily violent, not necessarily shocking, but very subtly uncomfortable, slightly shifting the perspectives⁷¹.

In the first place, an encounter with *Candida* in a context different from thrush is both fascinating and perplexing, especially for women:

⁷⁰ Personal communication.

⁷¹ Personal communication.

I found that people were, particularly women, really fascinated by it, seeing this thing [*Candida*] outside of their body, in a space where they weren't used to seeing it. Estrangement kind of response or affect, which meant that they could think about that differently⁷².

To make the experience of eating the *Candida*-leavened bread not entirely shocking but 'very subtly uncomfortable', Bates transforms the gallery into a convivial space. The breads are served with humus, cheese, and accompaniments. Conversation flows freely. In this way, the gallery visitors come into contact with the work, slightly disturbed, but sufficiently interested to stay in unknown waters.

In *Eros*, Bates opens up an experiential gap that gives rise to experimentation with *Candida* in conceptual and aesthetic terms. Before visitors are even able to posit the terms of their experience into already established and familiar accounts of the world, they enter into a zone of confusion conditioned and made possible by the fascination with *Candida* that is *The Unsettling Eros of Contact Zones*. In this zone, various elements come together along with the *Candida* characteristics classified by certain schemata of knowledge. Elements like the artistic statement that explicates the relationship with scientific protocols, discourses, and techniques, use of *Candida* as leavening agent for making bread, arrangement of gallery site into a convivial space, and the conversations with the visitors about their experience, *etc.*

Visitors are encouraged to share their thrush experiences with messmates at the table and to discuss with the artist her art practice, interest in *Candida*, scientific framing of it, the pharmaceutical solutions, or a host of other things. The performativity of the work arises from the coming-together of all these elements bounding temporal rhythms and spatial configurations with each other, dipping into the *Candida*-potentials. The region objectified by scientific activity with respect to *Candida*'s life conditions, presented in a restrictive expression designated through regularities and anticipatable results is now expanded towards the complexity of the relational field that yields aesthetic and conceptual outcomes. In this sense, the real product of the work is the whole world ecology as performed through *Candida*'s possibilities, crafted around scientific activity and the art gallery. The ecology of the work is experienced in processual rather than site-

⁷² Personal communication.

specific terms and underwritten by transitional rather than directional ways. In a way, this is what art is all about:

Art has its own performativity, own agency in some ways. Because what is important is to produce something which is aesthetically and conceptually interesting. They are not separate. They always come together as conceptual-aesthetics, material-semiotic⁷³.

Conclusion

In the end, scientific activity produces *Candida* typologies: *Candida* acts in commensal or pathogenic ways under such or such conditions; it activates such or such type of reproductive strategies under such or such circumstances. As much as *Candida* conditions and types proliferate in the scientific activity, it performs its abilities in different ways. New *Candida* questions in sciences originate from this horizon. A landscape of *Candida* nestles certain configurations according to the specificity of bodily ecosystemic relations. It changes according to the types of interactions on both sides: the so-called “intrinsic organismic relationships” and “environmental factors” of a selected totality. In this way, *Candida* landscape is modulated by the differential conjunctions *Candida* may enter into. Science selects a set of relations, eliminates others, and in this way describes certain possible paths of action formalized under the imperative of systematizing *Candida* connections as regularizable, repeatable, and uniform contractions. Whenever a selection is made from the *Candida* landscape, *Candida* effects sweep the categories, forms, and meanings in use, anticipating their not-yet but coming designations in potential in *Candida* constellations. Here, the possibility of relating to *Candida* outside the scientific context also emerges. The momentum that science accumulates while in transition from the not-yet known to the already-known is contaminated through curiosity. And with proper circumstances, curiosity appropriates a *Candida* constellation as interest(ing), and potentially triggers a process of research.

A *Candida* potential that is both constrained and conditioned by scientific arrangements in the experimental setting is ready to intermingle with cultural, social, and political aspects necessarily eliminated from the scope of scientific activity. Yet, they are also adumbrated in the

⁷³ Personal communication.

contact zones of the *Candida* landscape. The scientifically “interesting” is ready to become “conceptually and aesthetically interesting”.

Now, *Candida* is not only interesting for its typologies, shape-shifting abilities, reproductive strategies, and displayed sensitivities to the surrounding environment but also in terms of the imbrication of different material-semiotic systems, posing gender issues, naturallyculturally-induced human feelings, or the already-felt-but-not-yet-intelligibly-expressed life possibilities. Biological modes of relationality such as symbiosis or commensalism bring into fore not only conceptual, but especially, ethical-aesthetic dimensions of the ecological by transforming the reproduction of self-similarities into the proliferation of differences. This transformation *reflects* in the complex patterning of transitions, mixes, interferences, and resonations between research agendas in what I call echology: an ecology of ecologies, the ecology of problematic transitions that echo life’s possibilities couched in microbe-artworks.

* * *

What microbes can do resonates with what we can do with and/to them. How we make them visible, audible, and experienceable sweeps the fields of visibilities, audibilities, and experience-abilities with them as the conditioning of response-abilities. The next chapters will explore them within the specific problematic fields of microbe-images, microbe-sounds, microbe-milieux, and finally, microbe-ethics.

Chapter 4

What Do We See When We See Microbe-Images?

A Chinese emperor wants to erase the cascade fresco on his wall because the noise of the water won't let him sleep (quoted in Debray, 1992, p. 15). All the elements of the fresco come together in the scene in such a way to create an effect in reality: from the fictionality of the image to the reality of hearing sounds. The problem, however, is not the realism of the fresco. In the depicted scene, an aspect of the image relays itself to the coordinates of reality, and inversely, there is a capacity in reality that accommodates some effects of the image around which reality is reorganized. Thus, the real problem, beyond realism or fiction, is the power of images and how they perform in different modes. The fresco represents a certain reality, but its power comes from the effect it produces and the movement it triggers in perception. An image has a certain capacity to blur the already presupposed framework of daily reality. In fact, an image is less defined by its conformity to a presupposed reality than by the interval it opens in habitual functions, forms, and meanings. Paradoxically, in what is seen, an image points to a "beyond" as the performance of its force. This beyond is not the beyond of the sensible world or reality but the very production of the act of seeing that measures with its performance the distances of presupposed contours of reality. Might the noise of the water that upsets the Emperor's sleep today turn into tomorrow a noise that could threaten his whole Empire?

When it comes to contemporary images, it is obvious that they also gain meaning in terms of the power they have. The so-called image bombardment or domination of images of this century is partly due to this: the presupposed identity between an image and its designated meaning. There should be no gap between an image's visibility and what it shows so that the power of the image can be kept within certain parameters. The production of an image, its movement towards a beyond, and its standardization, or the possibility of a standard reception thereof, take place under the scope of the same operations. This is what makes an image problematic: a scene of tensions between the production of an excess and its minimization, the pretension for a standard, the possibility of a meaning or its evanescence. In this regard, not all images share the same status. As

with the advertising industry or the different image regimes that traverse media, the tension may remain relatively unnoticeable. Or the tension itself may be the founding act of a problematic field, as in the case of artistic activity where the image itself claims its rights. These scenes play out endlessly in-between these tensions to constitute what is called our life. Images produced in different fields, such as painting, cinema, advertising, the cultural industries in general, or in daily life contexts such as chatting, cooking, dancing, teaching, loving, show, make believe, think, or act upon us in different ways according to their intricate dimensions. The image itself is an acting, a production, an image-ination⁷⁴.

* * *

The fate of the image of microbe has thus far been shaped by the pathogenic context. For a long time, in this context, even new scientific findings on complex microbial behaviors did not manage to entirely dispel the assumption that microbes are entities that need to be eliminated. This immediately resonates in non-scientific contexts, on the political and social plane: certain groups should be excluded from politics and various actions or discourses that threaten the social order eliminated for the sake of ones that promotes “harmony” and “stability”. Sciences’ impartial attitude does not mean that the images produced in their field are completely sterile. Scientific activity uses all sorts of imaging devices, which play an important role in the production of scientific knowledge (see for example Jasanoff, 2001; Galison & Jones, 1998; and Latour, 2002). As Bruno Latour shows, two scientists arguing in front of a map have already been thrown into a horizon of meaning and field of actions, sensations, or methods (Latour, 1998, pp. 418-438). This, of course, does not occur in a linear fashion, not necessarily in the direction of the reproduction of a given meaning. It is this interval that enables scientific advancement. This situation, that is the emergence of an interval between the reproduction of scientific results and its meaning, becomes more evident in the images I call microbe-images, which are produced in interaction with the sciences but irreducible to them. Microbe-images are not correlated with instrumental ends but rather amount to a gesture of what remains inexpressible in science, attempting to give it aesthetic

⁷⁴ Facing such an immense complexity, it would be too easy to talk about the domination of one single mode of imaginal domain (in whatever terms it is posed, i.e. the society of spectacle, the seduction of images, see for example Debord, 1967; Baudrillard, 1981).

form. Certain scientific methods and techniques can be mobilized as if they are a part of a scientific research design but don't extend to scientific results. Rather, they produce a certain representation of what is assumed by scientific discourse. This is what makes them "iconic". What is seen in microbe-images represents the microbial world and this depiction of microbial interactions throws us into the intelligibility of the scientific world. The image assumes a certain readability but cannot be explained by scientific terms, or at least not fully. The image is what appears between the sensible and intelligible: the sensible forms held in the representation and not-yet-exhaustibly-explained life forms signaled by a beyond.

Microbe-images that are produced in, through, and by techno-scientific means incorporate heterogeneous elements gaining a visibility in the surface of the material frame of representabilities (always within the expanding circles of canvas, portraiture, performance, exhibition, etc.). At the same time, they also *somehow* point to a world within and beyond what is seen, making us believe in certain ways in the meaningfulness of that world. How do these two indispensable modes of image-producing operations come together? How are the sensible forms that we are able to distinguish in the visibility of microbial representations articulated with the presupposed scientific understanding of microbial relationships? To elaborate these questions, I will focus on two specific cases of microbe-artworks. The first is Isitan's "multi-species self-portraits" in *Hybridities: Almost Other*. This work visualises "hybrid" forms produced as a result of interactions of human beings with the microbial field by combining the materiality of the photographic negative with the tools and techniques of the scientific laboratory. Isitan's work mobilizes the often-addressed discourses of multi-species interaction and hybridities to show the constantly re-actualized human identity through interactions with environment. The second example is Lapointe's *Microbiome Selfies* (or *Portraits*) and his *1000 Handshakes* experimentations. Lapointe uses the tools and techniques of metagenomics to collect microbe samples and transforms them into what he calls "microbiome portraits". Different social contexts produce different portraits, showing that interactions with the environment are complex, each time changing the body composition. In both cases, the visibility of representation indicates the direction in which scientific knowledge points, explicating the intricate relationship between living beings through the determination of forms, functions, and categories. However, at a certain point, it remains silent in the necessary halting of their reproduction from one context to another. Microbe-artworks undertake this silence and give it existence by other means: they transform into an image. Microbe-images don't simply abolish the

silence but incite it into the composition of the visible-invisible, audible-inaudible, and finally, thinkable-unthinkable in the unceasing combat of an act of expressing inexpressible, that is called writing.

Although the decision to choose Isitan and Lapointe's microbe-artworks as examples was somewhat arbitrary, a few words can still be said about the decision. In the first place, even though it would be reductionist to use these two examples to generalize the nature of similar images, their specific ways of combining heterogeneous elements in the production of images appeals, mobilizes, and finally, indicates a certain pattern of discourses, approaches, and practices. Themes of hybridity, multi-species interactions, the fluidity of identity, and the complexity of ecosystems emerge from both works. Secondly, through these examples we have an occasion to observe two distinct modes of microbe-image production. They connect us to the formation of power in microbe-images through scientific activity's conjunction with extra-scientific domains. Finally, in Isitan's "multi-species self-portraits" and Lapointe's *Microbe Selfies*, microbe-images reveal two modes of imaginal gap. This cannot be simply filled by the articulation of the scientific and non-scientific, thus revealing an element in both artworks that resists intelligibility. The first point concerns the articulation between images and discourses. For this articulation to take place, it needs to be produced and the discursive level should make itself visible in the organization of the image. If an image is defined by what is irreducible in the visibility of what is seen, in other words, by an excess of the visibility over the discourse, then it should be produced by certain operations and therefore thought in operational terms. The presence-absence of images with respect to visibilities reveals the very power of images. This presence-absence constitutes the very fabric of reality but also interweaves the specific situations of the articulation between images and visibilities and images and discourses by connecting, fragmenting, annihilating, or reconstructing the heterogeneous elements. All these operations are mobilized by certain means that will find their fragmented unity in a certain type of materiality. This materiality incorporates all three levels of image production in their complexity, comprehending at the same time its dynamic, its movement towards a "beyond".

The Economy of Microbe-Images

In this section, I will not mainly concern myself with the relation between microbe-images and scientific discourses and practices nor with their reception in the art field. Rather, I will focus on how the image, at its foundation, operates to produce an excess. For this task, I will refer to Marie-José Mondzain's image analysis. In the first place, for Mondzain, an image is a philosophical and political question. Because when we see an image, we are transported into a world within the visible which itself remains invisible, the image becomes a philosophical question. Within the same gesture of apparition, the image overflows and empties the visible, making it constitutively fragile or indeterminate (Mondzain, 2003, p. 333; 2008, p. 7). For this very reason, the image-producing process requires conceptual elaboration. And it is a political question because the visibility produced by the image operations is the object of power formations that need to be governed.

In Mondzain's terminology, the object is icon and the image relation. But an icon is not defined through its form, its positioning in a spatiotemporal coordinate in a structural way. Rather, an icon is what induces the relational field of an image. The many-ness of the relational field is concentrated on the one-ness of the icon. But how is this selection, this accommodation *somehow* made? This is the second reason why the image is a political question. Mondzain defines the *somehow* as an economy, giving it very special meaning by following its plural etymological and semantic traces in antiquity and the Middle Ages (1996, p. 27). An economy (*oikonomia*), from the point of view of its semantic plurality and pragmatic flexibility (Alain Denault, 2019b), is defined as "*incarnation, plan, dessin, administration, providence, charge, office, accommodement, mensonge ou ruse*" (Mondzain, 1996, p. 27)⁷⁵. It is the process that holds together the related

⁷⁵ This plurality is important because it reflects not only a plurality of meanings on the semantic plane but also refers to the variety in the forms of thinking and action of that period. In this respect, it can be argued that in Denault's thinking, what essentially conditions the semantic pluralism of *oikonomia*, is a kind of pragmatics of multiplicity. This is again important because basically, neoliberal capitalism amputates the pluralism in question, and reduces it to the semantic locus of a single type of market relationships whose dominant tendency is infinite growth. Cornelius Castoriadis claims that there is a similar reduction of semantic pluralism for the term *logos*, which is the main pillar of Western rationalism. See Castoriadis, C., & Curtis, D. A. (1997). "Logos", in *World in fragments: Writings on politics, society, psychoanalysis, and the imagination*, pp. 213-405 Stanford University Press; also, see also Castoriadis, C. (1992). *Logic, imagination, reflection*. *American Imago*, 49(1), 3-33.

elements and heterogeneous components of iconic invisibilities so as to translate and, therefore, carry them into the field of visibilities (p. 51). Thus, the pragmatic multiplicity of the economy is enveloped by the manner in which the paradoxes of the icon are embraced by the articulation of the transcendent and immanent, truth and the real, ideal and the actual, “*avec le minimum de contradiction, grâce au dispositif imaginal et iconique*” (p. 125). The economy is the apparatus [*dispositif*] that the iconic thickness sweeps away together with imaginal depth, backstitched to each other thanks to the relative mastery of the interval (“*une maîtrise de l'écart*”) (pp. 39-40), opened with the imag-ination as an act.

An image is what escapes from iconic presuppositions according to its capacity to affect (p. 30) thus activating a capacity of producing “sensible propositions” (p. 319). An image transports us to elsewhere; it may or may not arouse our interest or trigger the construction of our “*regard*” upon it. This constitutive hesitation in the very fabric of the image does not only assume a margin of liberty welcoming the images in certain ways but also opens up the liberties to negotiation, a sort of test (“*épreuve*”). Depending on how the image-icon apparatus is composed, it may give rise to a cascade of events that operationally comes into surface by passing through different phases to finally culminate in a problematic node. This is the point at which the images’ capabilities, of what they can do, paradoxically emerges: while they operate as the lure for thinking, they remain unthinkable. From this perspective, microbe-images are neither ready-made artefacts nor the communicators of scientific discourses, the transmitter of transparent but complicated content to the larger public under a simplified form. Neither are they the rendered visible process of some alchemist’s pre-scientific experiments whose existence is tolerated in the biological laboratory. Rather, microbe-images are themselves complex problematic knots that pose questions to be elaborated beyond solutions of a given problem. As lures for thinking-writing, they should be constructed in terms of their own specific dimensions enveloped in their specific apparatus. In this sense, the double status of microbe-images—the fact that they are produced in the context of the techno-scientific formations but irreducible to their apparatuses in their expression—determines their problematic character. These problematic knots must be unfolded case by case in order to extend them to modes of seeing, believing, and thinking and writing—the expressions of their operations in their multiplicity.

Günes-Helen Isitan's *Hybridities: Almost Other*

In the expansion of scientific perspectives, every new finding and research question is accompanied with an increase in the specification of the studied phenomena's observed properties. This eventually gives rise to new subfields and may create new perceptions, insights, or ways of understanding life, nature, and the relationships between human species and other living beings. To this expansion we can add the growing diffusiveness of media tools that carry scientific data and experiment results into the wider public through the popularisation of science. This diffusion, however, shouldn't be considered as the transfer of ready-made content to passive receivers considered the illiterate public. Instead, it opens scientific activity into the wider social field from where it actually comes. If new perceptions, insights, or understandings are to be derived from the sciences, this will only happen in the heterogeneous problematic plane where scientific findings and data find their meaning in a wider social field. This plane is both heterogeneous and problematic because, beyond being just a semantic problem, new perceptions *etc.* can only gain the title "new" by envisaging social situations where they can be tested (*épreuve*). This shows how, at its heart, the image involves the movement from the invisible to the visible. Isitan's *Hybridities: Almost Other* reveals some of the more invisible aspects of the microbial field through the problem of hybridity. The manifestation of a problematic comes from the image's movement towards visibility, which brings forth some other problems. In this section, I situate Isitan's work in such a differentiating problematic field.

Hybridities: Almost Other, as the title already suggests, focuses on the microbe-human interaction as a process of producing hybrids. The concept of the hybrid entered the agenda of different fields with Latour's influential book *We Have Never Been Modern* (2012). According to Latour, the basic dilemma of modernity is to produce pure categories such as nature-culture, human-nonhuman, which completely separate things from each other but fail to sustain this separation in one way or another. For this reason, the emblematic of the modern world is the "proliferation of hybrids". Hybrids are neither natural nor cultural, neither human nor nonhuman but the connecting points of the ongoing, shifting networks of multiple actors that generate meaning in the modern world. Thus, the real problem of modernity is the proliferation of hybrids itself, their production, and beyond that, their zigzagging and intersecting lines connecting the heterogeneous elements together. In her work, Isitan explores microbe-human interactions by

combining the possibilities of the biological laboratory with the materiality of photographic film. As a result of the “hybridity” producing operations, the human world and microbial world that are designated as hybrids interact without respecting each other’s attributed boundaries. In this process, on the one side, we have microbial effects and the materiality of surfaces that reveal them and on the other, the symbolism of the human world that produces meanings penetrating each other in sensible forms. The first concerns the biological laboratory processes and photographic operations, the second the meaning-generating structure of human faciality. The image is what cannot be reduced to either but travels between the two. The “multi-species self-portraits” aspect of *Hybridities* blurs the expressiveness of human faciality and transposes it with colorful representations of microbes; or inversely, facial expressions and microbial representations fuses in the sensible form of multi-species portraits.

Maybe like all stories, *Hybridities* begins with the human-all-too-human. Maybe like all human activities, the artist makes the effort to as much as possible go further than the all-too-human to be able to get in touch with the “more-than-human”⁷⁶. Here, the human is not only the implication of human subjects in an artwork but also the involvement of all techniques, procedures, methods specific to the human world. In the first place, Isitan’s work is informed by the sciences that adumbrate the world beyond the human in which a not-yet-entirely-humanized field of the non-human appears as a humanness-fueling field of activity. Microbiome studies suggest that 50% of the genome found in the human body come from the microbial world (Sender et al., 2016). Another important point raised by the field is that, although different microbe species are defined according to a particular lineage and classified through genome sequencing, the environment in which they are extracted from as samples is always composed of complex modes of relationship. For example, a variety of microbe species in the human gut enter into different modes of relationship that will vary according to both the changes in the gut flora and the effects of the “external” environment (Mayer, 2018; Miller, 2018). Although the generic determinations about the microbial properties play an important role in the process of scientific research, the real emphasis of microbiome studies is on how environmental factors and a generic set of properties mutually affect each other and together produce specific modes of relationship. This situation constitutes a paradox. If the situation we generalize as environmental interactions consists of

⁷⁶ <https://www.interaliomag.org/audiovisual/gunes-helene-isitan/>. Accessed 15 March, 2020.

fundamental generic structural features and complex processes that lead to the emergence of certain characteristic behaviours, it can be said that the field from which the variables emerge is represented only to a certain extent under laboratory conditions. A research question which particularly arises in connection with the available tools (methods, techniques, and protocols) provided by existing methodologies explains how an unknown may be known (as a new variable). Therefore, an environmental dynamism that varies with interactions and generates complex compositions becomes included in a particular region of scientific knowledge as a variable-giving process and represented as specific configurations. Nevertheless, thousands of smaller questions that we encounter in the flow of everyday life pass unnoticed without giving rise to clear (visual) representation. The effects arising from environmental interactions restructure the whole field, from the germinal characteristics translatable into proper, full-fledged generic terms to extra-field effects.

Even if these effects are not *seen*, they are definitely felt. Until posited under the form of a research question, they pass unnoticed. The question sections the effects through the research setting where it is actualized and operationalized thus reconstructing it retrospectively. In this way, even though we cannot know exactly what is happening while we are eating *that* food or giving (or receiving) *that* kiss, in terms of microbial interactions, we can make connections between the generality of this-or-that food and the act of kissing and general modes of relationality. In other words, we arrive at a microbial landscape. A landscape with ladders not only extending from top to bottom or bottom to top but an infinite multiplicity of ladders, like in an Escher painting. Even beyond that, a dynamic landscape where the ladders also open into each other (thus continuously expanding), yet without having a definite starting or ending point⁷⁷.

Isitan brings two fields together: scientific methods and techniques and an “old” visual medium, photography. To isolate microbes, she uses a kit called *UBiome*. Samples taken from the face, skin, or gut of the project participants are stored in the appropriate conditions in a laboratory in Montreal to be sent to the *UBiome* center for analysis. Meanwhile, Isitan begins to take photos of the participants. This can be photographs of individual people as well as that of people living

⁷⁷ For a similar approach in terms of the entanglement of problems, see Haraway, D. (1994). *A Game of Cat's Cradle: Science Studies, Feminist Theory, Cultural Studies*. *Configurations*, 2(1), 59-71. For an application of this approach, see, Bates, T. (2015). *We have never been Homo sapiens: CandidaHomo naturecultures*. *PLATFORM: Journal of Media & Communication*, 6(2).

together. Isitan photographs the faces of the people from behind a semi-opaque plate. She asks the participants to avoid assuming a too serious or too smiley tone during the shoot⁷⁸. At the moment transforming the photographs into images, the samples come back into the picture. Isitan places the microbes detected by *UBiome* through DNA isolation on the photosensitive surface of the film, expected to produce effects that will reflect on the negative image. Microbial masse distorts the captured image by affecting the wavelengths of light collected in the film. “These microorganisms thus ‘edit’ the photographs of their ‘hosts’ by shifting around the inks of the film, dissolving their boundaries”⁷⁹. Thus, the composition consists of human elements in the form of facial figures but deformed by microbial effects according to species or duration of exposure.

As a result of the use of semi-opaque plates and the avoidance of the prominent facial expressions, it is possible to distinguish human faces in the work, but their distinctive features never dominate the composition. As well, the microbial mass placed on the film produces approximate geometric color combinations on the surface which intermingle with the more or less distinguishable human patterns. In some cases, the microbial effects completely distort the human figures and sometimes render them undistinguishable. All we see is the color spread over the whole surface in various nuances; sometimes geometric figures blend together and sometimes they clearly reveal their lines. In these portraits, the only thing left from the humanness is a silhouette that becomes more and more obscure in the background.

How are we then to approach the microbially produced by these portraits? How do the hybridities in which the ecosystemic complexity is summarized dissolve the dualities, in the words of Isitan, between human and non-human, macro and micro, individual and ecosystem in a

⁷⁸ This was a project in which my partner at the time and I had the chance to participate in. Originally, my aim was just to gain a sensibility for the field I was working in or, at most, to support an independent artist. The sampling process was almost like a formality. Things started to get interesting in the photo session. Isitan carried out the whole process with great care. She explained to us why she wanted to avoid strong expressions that would create a certain perception in humans about microbes. For example, if the human figure was too distinctive, this might suggest a situation related to that specific person rather than microbes. Or if the microbes effects on the film negative produced very distinct geometric shapes, they might be interpreted as symbolic; or if the effect produced very dark colors, it could suggest a pathogenic context. In the end, this personal experience played an important role in my developing of this chapter’s microbe-images problematic field.

⁷⁹ <https://ratsdeville.typepad.com/ratsdeville/2017/10/gunes-helene-isitan-visual-voice.html>. Accessed 15 March, 2020.

continuum⁸⁰? By which operations? While the hybridities open towards a certain representation of the microbial world, they also interrupt the figuration of the human world, especially the meaning-imposing nature of human faciality. What, then, is the relationship between this interruption of the relative givenness of the human face and the microbial aspects that don't fit into the contours of the human world? Finally, what is the meaning behind the disappearance of the human figures in the portraits and the predominance of color combinations from the point of view of the visibility of images?

Doing with Science

Hybridities do not refer to science only for using certain techniques. Everything starts with the erosion of the anthropomorphic understanding of life and living beings by certain scientific discourses. These discourses emphasize the complex modes of relationships between living beings and the environment. They do not only lead to a certain change in the conception of the world, but as an effect, evoke the possibility of entering that world through the appropriation of science's modes of engagement with living beings. This is also largely relevant for the world of microorganisms because knowledge about them must derive from the sciences. Meanwhile, a world entered through the sciences makes us feel that it is possible to generate different forms of expression that have to intersect with scientific functions, yet are irreducible to them. This feeling becomes tangible only if certain scientific techniques, procedures, and methods are put into use so as to be channelled towards other types of expressions. Thus, the images that emerge as a result of this process maintain their autonomy from the sciences as they crisscross elements pertaining to them. The production of these images that might also be contrasting with each other depends on which elements enter into composition and how they come together.

This contrast between the components of an image that traverse the sciences, and the image itself that consists of the specific coming-together of components, suggests that there must be a distance between an image and the conditions under which it is produced. There must be an image aspect that remains inexplicable in terms of its scientific dimensions. This aspect appears

⁸⁰ <https://ratsdeville.typepad.com/ratsdeville/2017/10/gunes-helene-isitan-visual-voice.html>. Accessed 15 March, 2020.

as a problem in language and thought in various spheres of human activity. For this reason, Mondzain proposes considering images according to an operational logic (1996). From this perspective, no image is established in a homogeneous way—that is, in a resemblance relationship with previous conditions and elements. Rather, what is in question is the production of a resemblance, but within the same act, deviating from its order as great as possible to generate the singularity of the image. Although the connections based on the resemblances might always be derived by the way of analogy in a structure, the iconic enigma as a question to the mystery of the image seeks the sensible propositions. This is also what determines the power (*la puissance*) of images: not given directly in the discursive and cognitive designations and unable to position the images in their spatiotemporal coordinates, images come into visibility by the “*opérations de la croyance qui soutiennent notre relation au sensible*”. This process culminates in the creation of a “fictional order” (p. 322), in parallel with the thinking-writing process.

In *Hybridities*, the photographic possibilities and appropriation of scientific discourses and practices are operationalized towards the production of microbe-images as the problematic coming-together of human faciality and microbial interactions. The problematic field is divided into various sublevels and processes that arrive at the disappearance of the human as the visibility of microbial forces. These sub-elements, from a Mondzainian perspective, are not simply intermediary steps arranged in a hierarchical order according to an analytical classification. Instead, they are operational fissurings that implicates multiple fictional propositions in themselves. In this way, *Hybridities* answer the question of “hybrids”, or rather, improvises a solution in the production of the “almost other”.

Two crucial factors needed in the production of microbe-images are access to laboratory facilities in order to apply scientific methods, protocols, and practices, as well as the proliferation of easy-use mobile kits developed based on citizen science. Both factors can be observed in *Hybridities*. Thanks to a kit named *UBiome*, the samples taken from the different parts of the participant’s body, including the gut, mouth, and skin are analyzed to detect the microbe species and learn which lineage they belong to. Participants are invited to take a survey used to correlate the microbiome data. The kits are sent to the company in the mail. The data are produced as a result of the amplification of a portion of the bacterial gene, encoding 16S ribosomal RNA using PCR and then sequences the amplified 16S ribosomal RNA gene in order to categorize the bacteria

at genus level⁸¹. *UBiome* analyzes the sequenced data through machine learning algorithms, which compares the data with its microbiome database built from the other samples sent in. *UBiome*'s report is crucial for the artist to learn how to take care of the microbes in a petri dish. At this moment, Isitan will learn and apply scientific methods and techniques to grow the microbes and keep them alive.

In the beginning, one might think that *Hybridities* were part of a scientific project. At any point in the process there was already a direction in which the sequence of events could unfold and be rendered meaningful, anticipating the generation of certain scientific results. For example, the visualisation of microbes in the petri dish by the aid of microscope leads the way to certain forms of *seeing* that would be associated to the certain forms of knowledge (Latour, 1996, p. 421). The artist's path passing through the laboratory does not only intersect the production of scientific knowledge but also points to the potential confluences at the limits of this process. For example, profit extraction is made possible at the point where scientific knowledge meets technology and conditions this process, for instance, through funding regimes. In this sense, the emergence of the bioeconomy is not simply the direct corollary of life sciences but enters into complex articulations with them (Haraway, 1991; Waldby, 2002; Rajan, 2006; Cooper, 2008; Thacker, 2006; Helmreich, 2008; Morini & Fumagalli, 2010). Secondly, the artist finds herself in a biopolitical situation which concerns the governance of living beings in the laboratory. The arrangement of the whole laboratory setting, as well as the living beings' becoming an object of observation confronts the artist with biopolitical problems (Munster, 2005; Da Costa & Philip 2010; Sützl & Hug, 2012; Abergel & Magnusson, 2014; Wolfe 2017).

In the end, what is looked for in scientific methodologies by the artist is not the description of certain functions by appropriate discursive tools but an aesthetic expression that will come as a result of laboratory practices. In this sense, another field effective in the production process of *Hybridities* runs in parallel with them, which, in a sense, will constitute a bifurcation point in terms of the course of scientific research. In this regard, the photography constitutes the second baseline phase of *Hybridities* apparatus.

⁸¹ See Scoles, Sarah. "I Sent a Sample of My Poop to uBiome –". *The Crux @ Discover Magazine*. 7 October 2015. <https://www.discovermagazine.com/health/i-sent-a-sample-of-my-poop-to-ubiome>. Accessed 20 March, 2020.

Photographing Microbes Alongside the Human Face

Isitan has used photography in some of her previous work. She conducted various experiments on the photographic negative, examining the relationship between a certain “objective” capturing of reality and, in connection with it, the procedures of translating the negative into visibility. In obtaining visibility, the structure of the filmic surface as well as the operations applied to it have a one-to-one effect on the result. Now, Isitan delves into these effects in *Hybridities* in connection with microbial worlds to bring them together in the materiality of the photographic surface. However, she is aware that living processes are not separable from materialities, that they are in fact entangled with each other. They become distinguishable only when they come to be expressed.

In one way, *Hybridities* indicate the existence of two separate elements that can be determined as clear and distinct entities but gain their meaning only within a prior field of entanglements which conditions them. Here, the artistic enterprise renders visible the joining of these two dimensions in the image apparatus. Namely, in the inexpressibility of the entanglements in language, representation, and theory within existing conceptual configurations but sensible in the forms and their corresponding propositions. Photography, in this sense, emerges as a medium that covers a certain type of human subjectivity that collects all the complex aspects of culture in itself within the encounter of a “default” objectivity. According to Jonathan Crary, this feature of photography amounts to the invisibility of the flowing time whose character is to invoke the cracks to open up to visibilities by the photographic medium as an apparatus (Crary, 1998, 2001).

Photography as an Apparatus

In *Techniques of the Observer: On Vision and Modernity in the Nineteenth Century*, Crary examines the formation of perceptual forms specific to modernism and the capacity of the new spectator-spectacle complexes to be articulated with existing cultural patterns or to create new ones (1998). Crary argues that, as a new medium, photography absorbed certain features of the *chambre noire* and combined them with other factors effective in the birth of modernity’s visual culture. Crary, following a Foucauldian thematic, interprets the articulation of cultural forms with old and new techniques both in terms of continuity and break. In the photographic apparatus, the

subject in which the *chambre noire* has placed in the position of an observer under the assumption that representations of reality dispose a certain order assumes a new status with the reproduction of picturesque naturalist codes through photogravures (1992). Thus, the assumed objectivity of the world and the ways human subjectivity represent the world to itself come together on a new basis:

On one hand, the observer is disjunct from the pure operation of the device and is there a disembodied witness to a mechanical and transcendental re-presentation of the objectivity of the world. On the other hand, however, his or her presence in the camera implies a spatial and temporal simultaneity of human subjectivity and objective apparatus. (Crary, 1992, p. 41).

The paradoxical status of the modern subject arose from this tension between the transcendental structure and its simultaneous expression in human culture. The fact that a certain regularity attributed to the succession of certain sequences of action with respect to observed events was only possible within the implication of an observer who incorporated a certain perspectivism in this order. The visual field, which was thus grasped as a *tabula rasa* in the ancient order, now turned into a recording surface where mechanical representations were interrupted by the fusion of different types of effects (p. 96)⁸². This situation will hence be enhanced by different observation techniques and leave its mark on the whole modern visual culture.

In Isitan's work, "objectivity" is not mainly due to photographic framing of privileged moments but arises from the effects microbes leave on the filmic surface. Nevertheless, the creation of the exposure effects depends on appropriation of the microbial field: hierarchical categorization based on an exclusionary logic that is the founding gesture of the notion of human is now replaced by a human-microbe continuum that consists of complex modes of symbiosis.

⁸² Another philosopher of media and apparatus—Walter Benjamin, essentially emphasizes these fusion effects rather than the reproduction of same experiential qualities. The originality of the account offered by Benjamin is that it refers to a rhythmic plane in which the visible, audible, tactile, etc. forms coordinate among themselves without reducing sensory experience to given channels of sense modes. At the same time, he conceives this plane in connection with a historically evolving set of technical apparatuses of "human sensorium" apparatuses. See Benjamin, W. (2008). *The work of art in the age of its technological reproducibility, and other writings on media*. Harvard University Press. An artwork is what performs this reciprocal determination in its very structure. It "telescopes" foggy density of an historical epoch through which its "aura" can penetrate with the specific constellation of rhythmic sensory patches. For a media approach to Benjamin's thinking, see Somaini, A. (2016). *Walter Benjamin's media theory: The Medium and the Apparatus*. Grey Room, 6-41.

Therefore, the photosensitive surface of the film captures the reconstructed gestures according to this logic. The image produced by the photographed objects is embodied in the apparatus in which the observer is dissolved in the materiality of the recording surface and resolved in a horizon which throws it into a microbial world:

[P]hotography had already abolished the inseparability of observer and camera obscura, bound together by a single point of view, and made the new camera an apparatus fundamentally independent of the spectator, yet which masqueraded as a transparent and incorporeal intermediary between observer and world. (Crary 1992, p. 136)

In *Hybridities*, the microbial world's assumed objectivity by scientific activity, and the posed objectivity of the spectator as captured by photographic medium come together in their subjective inseparability, not transparent but calling forth a "gaze" in its "biophotographic" apparatus. Biophotographic apparatus is neither a medium nor technical support. Nor is it a means of transmitting and receiving information related to microbial world, in other words, a way of instrumentalizing it. As Bardini defines, an apparatus is:

un objet à caractère complexe et composite, constitué de réseaux dynamiques de gestes, d'images, d'actes de langage ou de discours, ancrés sur des pratiques qui mobilisent des entités humaines et non humaines, naturelles et artificielles, dans des processus de communication (qu'ils médient) (Bardini, 2016, p. 1).

If one side of this dynamic network is engagement with the sciences and the potentials that the materiality of photographic film brings, another side leads to the complex interplay of gestures and images. This adds a faciality problem to *Hybridities'* biophotographic apparatus and makes the microbial field basically meaningful to this problem.

Whose Face?

The human face plays an important role in social relations. The face of the teacher, the boss, the statesman, the cleric describes something specific in each context. Semantic layers that make up each typology crystallize in a given situation and produce the assumed behavior calibrated according to the situation. A small gesture by the bureaucrats noticed by a monarch may result in decapitation. Although the face is unique to each person, it also belongs to the social world. "*Le visage appartient à une constellation complexe*" (Guattari, 2015, p. 102). Throughout the day, I

oscillate from one facial expression to another. Which of these faces is mine? Is it me who chooses those expressions or them who possess me?

The complex constellation of human faciality concerns all levels and layers of the social field but also functions by assuming certain reference points according to stratification degrees. The face is an unknown geography but there are always traces of history recorded in it which provide us with the grips to hold onto. In *A Thousand Plateaus* (1987), Deleuze and Guattari follow these traces through the process of creation of a standard type of subjectivity in Western civilization. This is the average European figure set in James Joyce's *Ulysses* or in Ezra Pound: adult-white-heterosexual-European-male-speaking-a-standard-language (p. 105). The face internalizes this average in time, and according to a given situation, activates the expressions assumed by the standard even though they cannot always be covered by the standard. Therefore, in an interaction, the face establishes the known standard frameworks of the social by sending signals of normality.

The problem of faciality has an important place in Félix Guattari's work. He explains that "*les coordonnées signifiantes d'un monde 'normal' sont déployées, et régulées à partir d'une visagèité centrale*" (Guattari, 2015, p. 340). Unless we are bathed in an intense feeling like love and get lost in a face, we *more or less* know how to interpret facial expressions and shape our behaviours accordingly. In an epidemic like leprosy, which caused massive destructions to an organism, it was the face that was the first reflective of the horrific dimensions of the event. It carried the signs of a frightening world that could have been even more frightening. With the affective tonality it triggered, it initiated the constitution of certain types of worlds (a social mood dominated by paranoia and prevailing central political power that dominates through insight from this mood). Although the expression is not as intense in the case of less severe diseases, still the face of a patient usually carries the traces of a sad, anxious, and gloomy world. For this reason, our approach to disease-causing factors has its share of these modes. When we look at a sick face, we see, along with many things, the *face* of microbes. But how do we see the face of microbes that don't make people sick? Do they also reflect on our face?

The formation of *Hybridities* is based on the production of hybridities; so, it has a circular organization rather than a linear one. There are two main poles for this circular organization. The first pole starts with the nonhuman: the microbial world that we reach through scientific discourses

and practices and the materiality of the photographic negative. As we progress through the dimensions of this nonhuman pole, we see that any element of human culture can be involved in the process and articulated with each other in an apparatus. At the other pole, we start from a point that we can almost qualify as pure humanity: the human face that we are able to recognize as soon as we see it and, the facial expressions that we can decipher without difficulty. These expressions will obtain their signification in relation to microbes, as in the other dimensions of *Hybridities*. But we are no longer in a world where microbes are conceptualized as disease-causing entities. Everything turns around the modes of relationship that derive from a symbiotic understanding of microbes. The millions of social situations we are involved in consist not only of factors that occupy human culture but also biological/microbial factors that are in constant interaction with them. Their manifestation in the face probably goes unnoticed. The envelopment of these factors within unnoticed situations might be brought into attention only when they become the subject of artistic initiative. However, it is also important to be careful. Although the constellations of human faces in the social field are complex, there are ready-at-hand implemented mechanisms that immediately reduce these constellations to preliminary significations. Even a small gesture can draw a curve of unfolding that immediately offers a layer of meaning whose signification framework is delineated in advance. Therefore, the world becomes immediately human in the function of the face's normality, arising as a result of the coordination of multiple social syntaxes (Guattari, 2015, pp. 340-41). Only some techniques of facial deformation might reveal the real potentials of the face, that is: a movement towards nonhuman forces.

Dismantling the Face

Isitan does not want her participants to have strong facial expressions during the photo shoot. A slightly twisted muscle or an excessively accentuated crinkle can allude to the world of diseases. A bit too of an emphasized smile might suppress the effects opened up by the microbial world by adumbrating the sentimentalist world of the all-too-human. A semi-opaque plate obscures the expressions appearing on the human face. The blurring process, while deviating the trajectory of expressions towards a certain signification, also leaves a minimum element of humanness. Therefore, the semi-transparent plate acts as an interface between the human face and microbial

effects (without such an interface, we would not be able to distinguish the hybrids). We cannot escape semantics of the face but we can deform it⁸³.

The apparatus of *Hybridities* is set up to show the interaction between the hybrids, nature and culture, human and nonhuman, individual and social, etc. While the first stage of this process is the photo shoot, the second stage consists of the installation of the photographic films into the petri dish. Thanks to the data obtained from *UBiome*, the microbes grow on agar and then on the film. They decompose the film negative in various ways. In this way, in her own words, Isitan “grow[s] an image rather than take[s] a picture”⁸⁴. The contours of the faces are slightly noticeable in the portraits that emerge. Instead of strong expressions such as fear or joy, calm or even serene expressions determine the atmosphere. The result is a landscape of color objects spread over the human face. This is a landscape because, as Mondzain has shown, an image interweaves various types of relationships in the economy of an apparatus in the process of selection, articulation, and accommodation (2009, p. 148). The operation of defacement constitutes the most concentrated form of this landscape: the examination of the microbial field through the question of hybridity and the creation of sensible forms that transports the iconic enigma of *the* microbes into images of microbially. This means that what the scientific activity actually induces is not simply the appropriation of the so-called transparent meaning of its discourses but the secretion of an “*ardeur*” or a “passion” that Mondzain explains as the real function of an image (1996, pp. 88-89). It is what provokes the creation of an image of microbes, even that of nature and life. It is what leads the artist to a research process. It is also what induces the research of artistic expressions that this process is woven into, which would end in the writing of these lines.

⁸³ The gesture of taking the human face into focus and moving it beyond given codes of human culture through various operations of deformation can also be seen in Alberto Giacometti’s sculptures. In Giacometti, the head and the face are inseparable, and the contractions, dilatations, or subtractions the body is subjected to load the intensity of the expression on the face. Human faciality has a paradoxical character. On the one hand, all faces are more or less alike; on the other, the slightest detail can throw you into unknown waters. Leo Costello, in his article *Portraiture and the Ethics of Alterity: Giacometti vis-à-vis Levinas*, links the question of ethics in Giacometti’s sculptures to themes of faciality in Deleuze and Guattari’s *A Thousand Plateaus* (1987) and surveillance in Foucault’s works. However, he develops the question essentially with respect to Emmanuel Levinas’ concept of otherness (In *OCTOBER 151*, Winter 2015, pp. 62–77).

⁸⁴ <https://www.interaliomag.org/audiovisual/gunes-helene-isitan/>. Accessed 15 March, 2020.

Another factor which contributes to this atmosphere is colorful groupings of geometric figures whose contours are not so clear-cut, but still distinguishable, produced by the effects of microbes on photographic film. Therefore, these two aspects come together in the fusion of variously colored nuances of faces in the iconic microbial portraits. Neither the microbial masses, which make their presence felt through color combinations, nor the expressivity of the human faciality predominate them. On the contrary, we feel the communication between them and that the composition is only meaningful thanks to a playfield of mutual implications. The longer the process of exposure to microbial samples takes, the more distorted the image negative contains. The result is that the faces are almost completely erased and the color groupings spread to a misty atmosphere. Experiments are made through the duration of microbes staying on the film and the effects are observed. Pessimistic, ineffective, destructive, dominant, passive: a range of affects may emerge within any composition.

A small trace of humanness, a small bend of hair or a facial trace, or the human posture of the neck extending towards the head can still be vaguely noticed. The human is still there but perhaps has become a region of color groupings in an almost indistinguishable way or has evaporated into an atmospheric element. As it is included in the biophotographic apparatus, the analogical aspect of photography remains one of the main axes. However, the microbial-human mixture has become so iconic that the imaginal movement tends towards a field of pure differentiations. In this other continuum in which the dualities described in terms of hybrids in an extensive space cease being the mix of distinct terms, the movements dissolve into fusions, entanglements, or mutual implications. In fact, such a movement has been present in the apparatus since the beginning, with the implication of *UBiome*. The samples taken from the participants that are transformed into a data set via algorithms and the livingness that is rendered possible and sustainable by this already puts a machinic configuration at the heart of the apparatus. However, in Isitan's artistic practice, rather than making such a structuration visible, what is important is how to reveal the human-microbe interactions and their ways of coming together without losing their determinable boundaries.

As an economy of image interweaves the dimensions of the iconic enigma, it increases or decreases the powers of seeing, and modulates between the contraction or relaxation of the imagination. Therefore, the modes of actions of which the immanent dimensions of belief come

into being basically amount to the negotiation of our freedom. In *Hybridities*, these relationships come from two directions—the microbial world and the human faciality and meet in an apparatus where the two aspects feed each other through gestures to become articulated. Therefore, for Isitan, the skin is not just a region for sampling but a zone of encounter with microbes, the locus of irreducibility. In this sense, skin isn't a limit, or a border, but an ever-changing permeable zone. The biophotographic apparatus becomes a sort of interface of the encounter. Microbiability leaves its mark on this interface and then continues its flight. Actually, this is what defines microbiability: being both part of the engagements and activities related to microbes and being irreducible to them, producing an imperturbable excess. As Mondzain shows through Marcel Duchamp, a visible site which is activated through an artwork, “*ne sera que membrane, c'est-à-dire pellicule, film sur lesquels le visible laissera sa trace illocalisable et furtive* (Mondzain, 2009, p. 335). This is what gives birth to the problematic character of the hyphen in “microbe-images” and its resolution in the biophotographic apparatus. A trail of microbiability is enveloped there. This occurs through the interplay between colors and shapes produced by reference to human faciality and microbes. It becomes clear at this point why the problem of image is a problem of belief, beyond cognitive and discursive designations: “*Les images ne sollicitent que la croyance*” (2003, p. 332).

The belief into which the microbe-image is attached by the biophotographic apparatus is related to the distinguishment of such an atmosphere. Whether taken in a pathological or symbiotic context, the image of a figurative microbe is replaced by a problematic microbe. Composition of the microbial field is accessed via hybrids. Microbes as collaborators of a project. What microbes can do is tested and experienced in these projects. What they can do can never be known or predictable in advance. *Ignoramus et ignorabimus*. But, still, somehow...

Portraying the Microbes: François-Joseph Lapointe's Artistic Experiments

With microbiome studies, we come to a point where the thick separations between the social world and the world of living beings studied under the name of biology don't work anymore⁸⁵. Our so-called human interactions require the contact of the whole ecology of our

⁸⁵ The genealogy of this thought dates back to the 19th century with historians, archaeologists, ethnologists, and philosophers such as Beckmann, Kapp, and Marx. Then, in the 20th century, Mauss, Leroi-Gourhan,

bodies. The simple fact of being alive already includes multiple activities taking place between different microorganisms. Even a small gesture that takes place in space and time in the social field does not only produce a social form but also physiologically resonates in the body. The human body provides shelter for a considerable number of microorganisms whose cells are more numerous than those of human cells (Rosner, 2014). Microbes live on our skin, inhabit every opening, surround our words and share our social actions. They form living communities in the landscape of our body. However, the interactions that take place within this ecosystem often disappear before they make their effects conceivable in the conscious level. In Lapointe's work, the invisibility of the ecosystemic happenings is rendered visible by the tools of the metagenomics and the possibilities of bioinformatics.

At the Intersection of the Social and Biological

In 2017, an interdisciplinary conference titled "Nonhuman Agents in Art, Culture, Theory" took place in Berlin. Organized by *Art Laboratory Berlin*, the conference brought together scientists, artists, and social scientists who work in the field of microbiome studies. Scientists shared the latest findings of their research. Artists explained how their interest in microbes emerged and how they use scientific findings, techniques, and methods in their work. Finally, social scientists talked about the social, cultural, and metaphysical questions that arise from the interactions between art and science.

One moment in the conference was particularly interesting in terms of the dialogue between sciences, arts, and social sciences. Lapointe, an evolutionary biologist from Canada, who wears both the scientist and artist cap, and a social scientist from Germany we couldn't learn his name, discussed the relationship between biology and social field. Before explaining his own art projects, Lapointe mentioned the effects of microbes on human behaviours, and how they shape our moods and actions. Afterwards, the social scientist took the floor and stated that the social world consists of complex relationships that are specific to the social field and that it can never be explained

and Simondon conceived technical objects as having a history and showed that they are part of the evolutionary processes in contact with morphogenetic laws.

solely through biology. In reply, Lapointe gave reference to some scientific research that explains the effects of microbes on the brain and stated that a biological conditioning may lie under the behaviors we describe as social. The social scientist then said that such an approach to the social field was a “disaster” for him from the perspective of the social sciences since it reduced the determinations of the social field to scientific explanations, and that such a reductionism crushed the complexity of the social world under biological positivism. Unfortunately, the debate ended with the departure of the social scientist and Lapointe continued his speech.

Maybe they were both right. Microbial interactions do have an influence on the brain, as demonstrated by scientific research, and have a share in our social actions. This shaping always occurs due to situations emerging in the social field and finds its meaning according to the social complexity on the other. They have to imply each other and enter into complex relationships.

In fact, in a way, Lapointe’s own work involves at the same the separation and the implication of the social and biological world. Extracting an image, regardless of what it is about, from the context on which it is founded and transporting it into another context is itself a social act (where the theme of de-/re-contextualisation in media/art theories come from, see Forbes, 2015; Schnugg, 2019). On the other hand, in terms of the questions and framework of Lapointe’s projects, the decontextualization would be a very limited expression of the image operations. The mobilized scientific methods and discourses are not simply the functional units that construct the totality of a work as intermediary tools but the contributory factors that partake in the image production process. This process refers to a complex field of interference, resonance, transposition, or mutual inclusion of factors in question. The role that metagenomics play in Lapointe’s work arises at this point as a contributory factor.

Microbiome Selfies

Lapointe defines his projects and role as both scientist and artist as a “mediator” or an “intercessor”⁸⁶. The scientific investigations in the field of metagenomics or environmental

⁸⁶ http://arcee.qc.ca/images/edito-2017-10/Arcee_2017_10_FrancoisJosephLapointe.php. In his doctoral dissertation, Lapointe proposes to use the term “*paradisciplinarity*” to describe the cooperation and exchange between science and art. An individual who would like to work in both art and science as separate

genetics that Lapointe conducts also nurture his artistic practices. It can be said that this transition from science to art is accompanied by a certain sense of excitement or enchantment arising from scientific findings⁸⁷. Metagenomics carry the information we have obtained about living things through genetics a step further and makes all environmental complexity a key factor in understanding life. In the biological study of living beings, it is crucial to determine its species, which classification it belongs to, and the taxonomic rank it has. The DNA sequence is often used for this purpose. The collected DNA samples are isolated and the specifications determined in terms of belonging to a certain lineage through existing genetic repertory. Genetic characteristics of a species remain always the same except in some exceptional cases (mutations). Whereas from the metagenomic point of view, all genetic sequences, defined or undefined, are important and the real relationships occurring in the environment always present these genetic sequences as

disciplines should give equal importance to both; furthermore, they should sufficiently know “both” cultures and be capable of translating them into each other. Apparently, Lapointe suggests a way to exceed the famous “conflict” between “two cultures” (see Snow, C. P. (2012 [1959]). *The two cultures*. Cambridge University Press). In this account, how a particular culture and each discipline’s internal dynamism for change and transformation arises and the implication of extra-disciplinary effects, however, remain unquestioned. It is also interesting to note that, for Lapointe, among the suggestions for explaining the interactions between different disciplines (such as *pluri*, *multi* or transdisciplinarity), only paradisciplinarity doesn’t fail and appear as a “success story”.

⁸⁷ For a brilliant analysis of the undiscovered directions of the modern notion of enchantment, see Bennett, J. (2016). *The enchantment of modern life*. Princeton University Press. Bennett’s project of rehabilitating the notion of enchantment as the opening to the wondrous aspects of life makes one immediately think of a Weberian context in which modern life is initially guided by rational goals in a modernized, bureaucratic, and secularized Western society (see Weber, M. (1976). *The Protestant Ethic and the Spirit of Capitalism*. London: George Allen & Unwin, 2nd edition). In another vein, a line can be drawn from Pascal to Heidegger who approach curiosity and enthusiasm with suspicion. In *Being and Time*, Heidegger discredits the notion of curiosity, linking it to the flightiness of the mediatic world, and ultimately, the chattering (*bavardage*) of the sciences, which takes human beings away from the essential aspects of the world (see Heidegger, M. (1985). *Être et temps*, trans. by Emmanuel Martineau, § 35 and following, Paris, Authentica). Michel Henry, one of the original figures of contemporary French philosophy, follows Heidegger’s analysis of curiosity to a certain point to, but then seriously deviates from him. For Henry, curiosity basically concerns ethics; an ethics of curiosity that is immediately connected with life rather than escaping it (interview with *Sébastien Labrousse*, in Henry, M. (2005). *Entretiens*. Editions Sulliver, pp. 97-113). For Bennett too, the main issue in enchantment analysis is ethics. Bennett ultimately places the subject in a pragmatic ground: enchantment finds its meaning only when it appears as an affective force it emits through moments of wonder as a source of energy, when it “propels ethical generosity” (Bennett, 2016, p. 88 and *passim*). Echological thinking and writing share with Bennett the desire to make wonder the main motor of our preoccupations.

intertwined, entangled, and irreducible to the clear-cut boundaries of the genetic determination of species. The orifices of the human body are suitable living spaces for microbes and every relationship occurring in the environment re-produces the microbe-organism relationship. On the other hand, this continuous interaction with microbes does not come to the fore unless it turns into an illness that makes the presence of microbes felt through some symptoms. But this doesn't mean that microbes don't produce effects apart from these symptoms. According to the popular scientific theme of recent days, these effects resonate throughout the gut-brain axis⁸⁸. A whole social world is in a dynamic interaction with the microbial world. However, the expression of this interaction can gain a visibility in the epistemological sense only through scientific research in accordance with scientific methodologies. Scientific research links this change to categories through the mathematical expression of functions. Lapointe renders the complexity of the microbial world visible, this time not in the epistemological sense, but in the aesthetic. Microbial interactions, attachments, detachments, fusions, and groupings become representable by means of metagenomics and bioinformatics.

In the microbiome portraits of Lapointe, algorithms are used in order to limit and select the complex relationships between microorganisms to sequence the genetic patterns which will serve as the cutting points of environmental interactions. The economy of DNA pertaining to the logic of concatenation of sequencing is realized by algorithmic methods, and in the end, summarized in an iconic image. Although the produced image appeals to perception in terms of the interplay between colors, lines, and geometric figures, it is basically inseparable from the logic of scientific procedures that apprehend living beings and liveliness in particular ways. Therefore, the image operations are inseparable from discursive formations, and they come together in specific ways. In this way, other problematic layers that are in contact with scientific contexts that cut across them come to the fore through artistic mediation.

⁸⁸ See for example, Jane A. Foster and Karen-Anne McVey Neufeld, "Gut-Brain Axis: How the Microbiome Influences Anxiety and Depression," *Trends in Neurosciences* 36, no. 5 (2013): 305–12; Mark Lyte and John F. Cryan, eds., *Microbial Endocrinology: The Microbiota-Gut-Brain Axis in Health and Disease* (New York: Springer, 2014); Mayer, *Mind-Gut Connection*.

On the flip side, this initiative finally has a performative aspect. Through Lapointe's different projects—*Microbiome Selfies*, *1000 Handshakes*, and other projects that operate in the same direction, creating portraits in series renders the imperceptible difference of habitual social acts (such as handshaking, kissing, or eating) visible within each sampling process. The difference becomes representable in the image as a result of an extensive projection (or extrapolation). The intensive difference—the difference enveloped in ecosystemic entanglements, is transformed into an image and rendered extensive through the operations in question. We already know, almost commonsensically, that each act is different from another. This information, however, is precisely what plays the founding role of ensuring the continuity of identity by bracketing environmental complexity and thus limiting visibility. But along with the extrapolated difference, the unshakable status of identity comes into disruption. Identity loses its homogenous integrity so as to reinvent itself through the seriality of the heterogeneous elements integrated into a collectively reproduced, yet unstable entity. A certain continuity between social acts is produced in terms of returning to the recognizability of the same personological agent: an essentially dissonantly harmonious, fragmented being.

The Iconic Enigma of Life Sciences: The Idea of Co-Development

We have already seen that the history of microbe studies consists of the bifurcations in terms of the divergence of research agenda. The discovery of DNA is crucial in this history. Increasingly, it consolidates the already existing image of living beings as perfect copying mechanisms, while on the other side, the assumption that all the operations of a body are determined by DNA codes as the central locus of an organism is constantly interrupted. More and more, the variation is introduced into the frame of reference as the necessity of adaptation. Accordingly, if a microorganism were to make perfect copies of itself every time, it would be horrible at adapting to new environmental challenges. The most efficient way of producing variations would be to absorb some DNA from elsewhere that would help the cell adapt to a novel environment. Then, from a more ecosystemic perspective, groups of microorganisms don't only compete with each other or with other groups in order to gain territory and resources but also need to cooperate. From the genetic perspective, this happens by the acquisition and implication of new genes in the combined function of a particular set of successful genes gained as a result of the

duplication of existing genes and the variation-creating adaptation of the copies (Ohno, 2013). In order to understand the production of the variation through the generation of copies, microbiome studies start with the kinds of microbes that live in different, mostly hostile environments such as hot springs or the Sargasso Sea (Pace, 2009; Lane, 2010). These studies have opened the path towards discovering the complicated ways of communication among microorganisms (e.g., quorum sensing) and the same research setting came to the agenda for the microenvironments as a subway or a museum where people come into contact with each other (see, for example: Green, 2011, 2014; Kembel et al., 2014; Adams et al, 2015). The environments that take part in daily life or daily objects such as a shoe or a cell phone are considered surfaces that recompose the relations between humans and microorganisms. Each contact point causes certain changes in the microbial fauna through the associated orifice regions in the human body. Microorganisms (e.g. the microbes that live in the human guts) do not directly impinge on an organism by physically reshaping it but through the insertion of microbial genes via their host. Developmental biologist Scott Gilbert calls this co-development (Gilbert et al., 2012).

The studying of these co-development processes gained some momentum due to the application of metagenomic methods. Metagenomic methods include a series of computational approaches that allow sampling the environment without assembling the genome of a species but by collecting a lot of small fragments of DNA from different species. This might lead to the cataloging of many previously unknown microbial species, as well as lists of millions of microbial genes collectively known as human microbiome. These processes show that microorganisms perceive environmental conditions and react in ways advantageous to the continuation of their lives. They can communicate among themselves and with the environment through complex molecular processes. The functional operations rely on chemical and electrical networks or in the higher levels on the ecosystemic factors. For this reason, computational approaches come into prominence in terms of explaining these processes as well as the behaviors of microorganisms⁸⁹.

Contemporary techno-scientific apparatuses have a capacity of proliferating innumerable molecular activities in which a certain lively potential is enveloped by an algorithmic functioning. Concepts such as biomedica, remediation, or recontextualisation were produced to understand this

⁸⁹ For a brilliant analysis of the aparalel evolution of biological sciences and informatics, see Johnston, J. (2008). *The Allure of Machinic Life*. MIT Press.

situation, which basically indicates “the increasing integration of biology and informatics, molecular biology and computer science, DNA and data” (Thacker, 2005, p. 22). However, the most important point in this algorithmic logic is that the behaviors of living beings do not appear according to a predetermined pattern. They consistently produce emergent characters in the process according to the nature of the third-generation cybernetic machines (Agar, 2005; Baskin, 2005; Kenny, 2009). Hence, the application of logical complexity of algorithms such as in deep learning or machine learning procedures meet with vitality processes such as growth, reproduction, and complex symbiotic relationships between different living beings. What is important here is not that the cellular networks do perform the functions expected from them but that they display some behaviors apart from the pre-determined paths during the process they operate. That the initial conditions cannot cover the whole process or determine the end product shows that an unpredictable order has been running the whole time in parallel with the order of forms, functions, and structures. Now, the whole picture is reversed. It is not structural clusters through which molecular functions are deduced but the unstable particles that give rise to statistical aggregations that would be turned into mass data for bioinformatics. In other words, the molecular is not a scale defined according to the quantity, functional complementarity, but a whole different level of biological processes which always bring an excess of potentiality under the form of unpredictability.

A Metagenomic Economy of Art

In *1000 Handshakes* and *Microbiome Selfies*, the two dimensions—the molar and the molecular dimension are articulated in the metagenomic economy. By the molar dimension, we can refer to the dimension of forms, functions, and structures, while the molecular is expressed in biology through the margin of unpredictability in its opening to ecosystemic complexity. The metagenomic economy summarizes the complexity of microbial interactions in the form of images. The process starts with a simple (social) act such as handshaking, eating, or kissing, etc., and then consists of taking samples from relevant body parts, and the conversion of them into portraits (selfies) by the metagenomic tools and algorithms. For example, in *1000 Handshakes*, repeated in Montréal, Berlin, Baltimore, and Copenhagen, Lapointe, accompanied by his team, shakes hands with 1,000 different people. After each 50 handshakes, samples are taken from the palm of his

hand in order to analyze the different microbiome networks. The collected samples are used for DNA analysis of the microbiome. From this analysis, some visual images are generated through bioinformatics programming. Similarly, in other projects such as *Devenir Batman* (the visualization of the effects of eating a bat), *Microbiome Kamasutra* (the visualisation of the effects of having sex), or *Sacré Microbiome* (the sampling of the “sacred objects”) that might be seen as the derivations of the *Microbiome Portraits*, the portraits are created to show changes in the microbiome composition within each act.

For the creation of images, Lapointe uses a next generation sequencing platform, a network visualisation software developed for bioinformatics work. Unlike the analog microscopes of previous generations, it works with digital DNA recording. The final step of this process consists of a network analysis which links different microbial nodes to each other. We can then see the whole interactional field of different microbiome networks in the portraits of the microbial profile of a given social act. To be able to visually transcribe these physical interactions produced in a specific time and place, the artist uses bioinformatics which allow him to graphically recombine the samples. Lapointe and his team first set out to determine the genetic similarities between different families of bacteria found in the samples. To do this, they use an RNA sequencing tool in a MiSeq platform, which allows them to assemble small genomic particles. The MiSeq platform helps to perform various tasks of sequence in a single run, clonal amplification, genomic DNA sequencing, and data analysis with base calling, alignment, variant calling, and reporting. The connection between two bacteria is established when the selected gene sequences share more similar data than the average. The next step is to give these connecting networks visual form. The data obtained are analyzed using QIIME, an open source bioinformatics tool for microbiome analysis designed with the aim of producing graphs from raw data generated by the sequencing platform. The network of genetic similarities is plotted using a Fruchterman-Reingold algorithm, an algorithm based on a force system applied between nodes and arcs. In the project, the connection between species of bacteria is represented by a certain color produced by the two algorithmic forces. In this way, the already designated entities such as self and other dissolve in the image and disperse through temporary local agglomerations of different colors expressing the internal dynamics of an interaction.

The use of different algorithms for different ends transposes the engineering nature of the project into the whole continuum of life as the modes of interrelations, from molecules to microbes, microbes to human organisms, and from human organisms to cultures. Whereas each mode comes to light as a composition of forces according to its capacity of fulfilling a certain degree of power, the modes of connection between living beings would also be affected by different factors, both quantitatively and qualitatively. The expression of this approach in the life sciences is the theory of endosymbiosis. According to this theory, symbiotic relationships do not only concern the processes within the living beings themselves but also extend to the relationships between all living beings, and ultimately, to the whole ecosystem. Each molecular event is populated by heterogeneous elements and shaped by selections according to the capacity of each element participating as a factor. Additionally, they resonate in the mutual web of relations between different bodies and milieux, in relation to the ecosystem of bodies (Parisi, 2004, pp. 30-31). The production is everywhere. Not only the affair of human subjects or groups, it also takes place at the molecular level of cells, enzymes, DNA, and genes (Thacker, 2006). “Genes synthesiz[e] protein products, enzymes catalyz[e] cellular reactions, and cells metaboliz[e] useful compounds for medical and economic ends” (Thacker, 2005, p. 45). All the elements of milieu at all levels participate in their making, and the milieu, in turn, are made by them. Each time, the algorithmic structuring get complicated by systemic relationality and generates new modes with each complication, which opens a field of “unexplored potentials” (surplus-value of algorithmic effect). What is expressed in each field of activity is this excess, captured in a certain way and channelized according to their frameworks. This is what Eugene Thacker calls *biomedia*, the inseparability of the product from the process, of biology from media. Biology and media penetrate each other in expanding circles, from gene discovery to genetically-designed drugs, cell therapies, GM foods, etc., to pharmaceutical, biotech, and information technology industries. A medium is not simply a tool, an instrumentalized mean, an ineffective extension of a given process, but, as Thacker put it, is itself “a process, a transformation, and an objective” (Thacker, 2003)⁹⁰. This also means that

⁹⁰ From the biopolitical perspective, see also Rose, N. (2007). *The politics of life itself: Biomedicine, power, and subjectivity in the twenty-first century*. Princeton University Press. As Rose argues, “the central logic of our current engagement with the vital order is not to know but to transform it” (p. 83).

every act that produces a biological potential is produced in a certain biopolitical situation in which:

life and living being become a matter of governance but also a matter of production of new forms of life, the engendering of new ontologies, styles, utterances of ‘what counts as worth living’. (Parisi 2009, p. 157)

Thus, we can link the problem of life, which concerns how and what kind of products a potential emerging in the field of biology will be transformed into, to a problem of image. According to Mondzain, the problematic nature of the image, the question of what counts as worth seeing, believing, and thinking is reposed in each presence of the image. Whenever a biological potential is produced and translated into a form of visibility by the mobilization of certain tools, the political question of “who shows” and “who believes” already starts to unfold from the very beginning. Throughout the process, the gap between “the believing without seeing” and “the believing by seeing” (Mondzain, 2009) is expanded or narrowed according to the delineation of life continuum. Our submissions and freedoms are related to the binding of this problematic aspect of the images into the visibility regimes around these political questions.

For this reason, the image is a crucial issue for the survival of power formations. The same operations that produce the image according to a particular economy and reveal a potential also appear to be translated into institutional terms. According to Mondzain, patriarchal institutions were the first to realize this. Interestingly, the 8th century Byzantine iconoclasm debate is at the heart of Mondzain’s image analysis. The aim is not simply to establish links with the contemporary situation of images through the history of Christianity. On the contrary, Mondzain captures a philosophical moment in these discussions, crystallizing the problem of the image’s constitution in Western metaphysics and politics.

This is the main contribution of Nicéphore, a central figure in Mondzain’s analysis, in his discussions of Byzantine iconoclasm (1996). Nicéphore suggests that an icon is such a powerful tool that one doesn’t need to know all the theological discussions about the incarnation in order to believe in God. It presents a fragment for the providence of God and reproduces it through the specific dimensions of the here-and-now (by means of economy as a *dispositif* or *accommodement*) in affective terms. Meanwhile, the word (*la parole*) is also important because it is only possible by word to sustain and reproduce the enthusiasm that an image induces. Otherwise, as seen in the

times of Nicéphore, the political power that advocated iconoclasm might tend to eliminate all the conditions that produce an image.

In terms of the production of microbe-images, the political problem arises from the way life should be managed and which articulations would be established within the biotechnological or bioinformatical tools⁹¹. In the Lapointe's portraits, all we see are aggregates of various colors and what we see only makes sense with respect to the knowledge that concerns the microbial world. The possibility of constructing a relationship with respect to the microbial field passes to the spectator through the arrangement of the art gallery or the mediation of the art statement as to condition certain modes of relationality. On the other hand, if production at molecular level is shaped through a sort of algorithmic unconscious that unleashes a potential, then the microbe-icon apparatus already incorporates political formations in potential to be unfolded in the image movement. That is also to say that microbe-images are not directly given so as to mold the forms ready-at-hand but are modulated by image operations as the climactic particles of the apparatus. Thus, microbe-images diagram a multitude of relationships rooted in biomedicine, which is above all relayed to a digital plane, then channeled towards visual traces by an algorithmic processing of microbial interactions. Now, it seems that a whole sphere of relationships is linked to a specific spatiotemporal configuration. Firstly, the configuration is reduced to a play between data and expression subsequent to the traces of data produced by the overlaps and distances of these in the appearance of a trajectory of lines animated by a range of colors. Then, it is recapacitated so as to imbricate all the mixes and potentiations in the process. In the microbiome portraits of Lapointe, we can thus use the term "portrait" in the technical sense of portraying the microbial complexity by techno-scientific means. Ecosystemic factors are summarized in the series of portraits. The production of differences in regards to each project's context—handshaking, eating, kissing, etc., cannot be encompassed by a fixed identity. Instead, the previously unconnected parts are put into "communication" in the imaginal apparatus. As Robert E. Mitchell draws attention, putting the disparate elements into communication is one of the characteristics of the vitality of bioartistic

⁹¹ Thacker draws attention to the risk of an artist's instrumental use of technologies and scientific discoveries in pursuit of the latest fashions, which might end up simply promoting the biotechnology industry (2006). See also Hauser, Jens, Capucii, Pier Luigi, and Franco Torriano. Eds. (2007). *Art Biotech*. Bologna: CLUEB. Hayes.

practices (Mitchell, 2012, p. 102). At this point, while the image attracts the spectator to its own passional dimensions, it also opens feelings, thoughts, beliefs, and the attitudes into a negotiation. In Mondzain's words, this dimension takes place through the articulation of the *puissance d'agir* with a certain power of knowing⁹².

In *Microbiome portraits*, this dimension of knowledge is not lost. To the extent that it meets with the discursive dimensions of the artistic statement, and more broadly, with the techno-scientific images that frame the emergence of forms of life, it engulfs the relationship with microbe-images. On the other hand, the passional dimensions of images which essentially implicates them can never be exhausted by intelligible evaluations. There is always a residue of discursive operations that concern the competences and articulations of the regimes of signs. This residue persists in the operations that cannot any longer be described as discursive.

The Calling of Microbe-Images

Thus, the image is defined according to a dual movement of narrowing-expansion and contraction-dilatation. With each process, the samples extracted from the environmental complexity are extended to that possibility that the entangled bundles of relationship will be summarized. Where the complexity of nature meets with the complexity of its conceptualisation (the disciplinary intermingling), ecology becomes the economy and economy, the ecology (Denault, 2019a). Each DNA replication finds its partial expression in genomic sequences and leads to the determination of species corresponding to the samplings. In its turn, the environmental complexity is summarized by the metagenomic operations and spills into the appropriate scientific expressions that condition other types of activity. The transition from the invisible to visible is made possible by this economy, which governs the:

rapports du sacré et du profane, du visible et de l'invisible, de la vérité intangible au cœur d'une réalité ondoyante et relative, des relations entre le lisible et le visible aussi bien qu'entre la rigueur de la loi et l'adaptabilité de la règle. (Mondzain, 1996, p. 28, quoted in Denault, 2019b, p. 77 78)

⁹² https://www.liberation.fr/debats/2015/11/18/le-corps-face-aux-images_1414437 Accessed 16 March, 2020.

Although the concept of economy, as elaborated by Mondzain, takes its origin from the religious context, it essentially implies “*signe d’un paradoxe le domaine non conceptuel qu’il fonde*” (Mondzain, 1996, pp. 217-218). The specific operations that make selections and accommodate various elements produce a spectator-spectacle complex in which the spectator finds its position according to modes of affectation. As Mondzain explains, the spectator remains in a passive position before the images that are imposed by techno-scientific capitalism which masters in their (re)cycling⁹³. These images remain at the level of the *clichés* and present a relative gap that exceeds the given parameters of the visibilities only to a certain extent. On the other hand, the emerging conditions of an image at a certain interval that allows the accommodation of different points of view and the image hitting clichés mutually presuppose each other. There isn’t a situation where a certain margin of freedom does not exist in the *clichés* or that there is no *cliché*-type investment in the imaginal movement⁹⁴. Levels and scales interlace with each other and this passional intermixing calls forth “readabilities”.

Thus, the hierarchy between the artist as an authorial figure and spectator as the reproducer of the imposed conditions is abolished and replaced by the aparallel distribution of their difference in a common ground set forth by image operations. In this regard, the production of images cannot be taken as the imposition of pre-assigned meanings. It doesn’t function through a top-down logic but according to the capacity of the sustenance of an invisibility that is the *puissance* of the image (Mondzain, 1996, pp. 83-84). It distributes and manages (*la gestion*) the visibilities, only to the extent that it gives a certain margin of freedom, which “*s’exerce sur le tissu vivant, et labile, de nos sens et de nos productions*” (p. 83-84.). Denault defines this role of economy as a “*pratique, pédagogique, universelle, accessible à tous*”, which makes “*l’image iconique est apte tout à la fois à incarner des corps, en porter la valeur de symbole, codifier l’indicible et susciter des adhésions affections*” (2019b, pp. 73-74).

A certain threshold of popularization, which certain scientific data have reached, arrives at a certain level that might incite the creation of certain modes of life through the production of a field of visibilities. The image finds its ultimate power, neither in the reproduction of the visibilities

⁹³ For the overspilling of this logic from and into biology, see Bardini, T. (2011). *Junkware*. U of Minnesota Press.

⁹⁴ For this mutual implication in Deleuze’s treatment of cinematic images, see Sauvagnargues, A. (2015). *Deleuze et l’art*. Presses universitaires de France.

through *clichés* nor in a certain detachment from them by the survey of a free gaze. Instead, as Denault puts it, it finds its ultimate power in the animation of beliefs and aspirations (pp. 73-74.). It makes us believe in or aspires us to the discovery of related dimensions or constitution of other reflections or readabilities in the living texture of the image. Whenever a new scientific set of data, discourse, or finding enters our lives, it also triggers the production of an image, and through this image it aspires to our belief in the world as well as in certain practices. However, we cannot separate this belief from other fields of activity, from the techno-scientific ways of producing excesses for economical or biopolitical ends. The belief in the dimensions of the world established through certain forms of life and modes of production of livingness in microbe-images produced by artistic engagement tends to a site Mondzain considers in terms of an imaginal zone where an image fully obtains its eventful dimensions. This site is not outside of the “power *dispositifs*” and takes place precisely at the heart of them but refers to “*le site invisible de l’énergie sismique qui redistribue sans cesse les places*” (Mondzain, 2009, p. 338).

In general, the literature of biopolitics lays stress on the treatment of living beings and the control or governance of life modes. The conditions of the reproduction of characteristics defined as inherently belonging to livingness are now defined with respect to the implication of the biological potentiality emerging in the vital processes. Livingness is about the conditions of emergence of this sort of potentiality and its capture by existing apparatus or the creation of new ones devoted to this end. Meanwhile, this also assumes that these two dimensions are irreducible to each other. That is to say, biological potential is essentially explicated through its capacity of going beyond existing formations of capture. A potential is, by nature, concerned with the emergence of the unexpected. As Catherine Malabou has stated about biological potential:

The innumerable innovations of the living are built . . . on the basis of the—temporary—repression of most of their potentialities. And the wealth of these potentialities that sleep in the depths of our body no doubt surpasses by far anything that we can yet imagine⁹⁵.

Biological potentials are related to unexpected transformations. They spread over the whole social field in their operativity and realize “a veritable deconstruction of program, family, and identity”,

⁹⁵ https://criticalinquiry.uchicago.edu/one_life_only/. Accessed 12 January, 2020. Malabou gives two examples for this situation through epigenetics and cloning. See also Ameisen, J. C. (2003). *La sculpture du vivant: le suicide cellulaire ou la mort créatrice*. Éditions du Seuil.

thereby shaking the sovereign political subject and bringing other political features to the agenda in accordance with the plurality of “biological life”⁹⁶.

In *Microbiome portraits*, daily social acts such as eating, drinking, or kissing intersect with various biological contexts. The image itself is the result of the operations that weave the heterogeneous multiplicities between fields according to the actuality of the situations in which they come together. This is also the inaugural gesture of the image zone. Beyond any kind of cognitive or discursive investment, it collects the whole complexity of the existential interweaving in a “site of indetermination” as the niche of the freedom where “*l’infinité des possible*” can be experienced⁹⁷. The imaginal apparatus induces sensible propositions. It consists of the specific articulations between the icon and image. Elements of power formations participate in this process through their specific germinal forms but are ultimately swept away by the founding gesture of the image (*les gestes imageants*) so as to reveal a singular *puissance* of the image:

C’est pourquoi les trois régimes opératoires des gestes imageants désignent trois registres politiques qui concernent la relation de notre puissance singulière face aux pouvoirs institués. (Mondzain, 2009, p. 338)

This political register in which the image finds its real meaning, does not completely erase the dimensions of instituted powers. By fusing them with the singularity of the operations that make up the image movement, however, they are forgotten as the spectators are thrown into a sort of trans state. In this way, drafts of a power come into light:

En un mot, l’immense zone culturelle et cultuelle où opéraient et opèrent encore des énergies inassignables, des désordres féconds, des chaos inventifs, des brouillages créatifs, et donc finalement une histoire des contre-pouvoirs qui n’ont jamais cessé d’exister fût-ce que prix des persécutions, des asservissements et des exclusions les plus féroces (Mondzain, 2009, p. 330).

Microbiome portraits enter into the microbial complexity through a series of portraits. Although this world is being revealed through metagenomic methods and algorithmic operations, the actual dimensions of the icon’s visibility refer to this microbial complexity which conditions

⁹⁶ https://criticalinquiry.uchicago.edu/one_life_only/. Accessed 12 January, 2020.

⁹⁷ https://www.liberation.fr/debats/2015/11/18/le-corps-face-aux-images_1414437. Accessed 20 March 2020.

the reconstruction of identities. These icons carry the elements collected by the imaginal apparatus with its unique economy into the membrane. Biological potential is indeed paradoxically produced in this membrane between the drafts of perceptibility and the mystery of invisibility, where the almost recognizable forms (*clichés* in formation) and imaginal gestures echo each other. According to Mondzain, in terms of both the consistency of the heterogeneous elements and their fragility, Duchamp is a paradigmatic example:

[Duchamp] met en œuvre une zone imaginale et rêvée, où une matière rêveuse et impalpable métaphorisée par le gaz, la fumée, l'odeur, les flux, les poussières et les évaporations, détermine le champ impensé de l'inframince, cad de la zone où le semblant apparaît et disparaît. Le site visible ne sera que membrane, cad pellicule, film sur lesquels le visible laissera sa trace illocalisable et furtive. (Mondzain, 2009, p. 335)

The visibility of this site in which multiple heterogeneous elements like “*gaz, fumée, odeur, flux, poussière et les évaporations*” come together is different than epistemological visibility, which explicates an unknown. Its consistency does not come from an organizational configuration but occurs in an “*inframince*”. Elements’ apparitions and disparitions in an imaginal zone are so accelerated that the elements escape from particular identities and general categories. Yet, the imaginal zone is still capable of capturing the free-floating signs on a thin, fragile ground (still a ground, but the ground of the groundless). This groundless ground, the site of unthought or rather the proto-territory of thought, is both what paralyzes thought and plays a founding role in the moment of flourishing new thoughts. In terms of the microbial world, this is a moment of re-encounter with the uncanny side of microbially, the one haunting it since the very beginning. The term *microbe*, which has undergone various transformations until arriving at microbiome studies, is constituted within the infinite mode of existence between pathogenicity determined by the horizon of death and symbiotic modes of relationship where living beings interrelate with each other in different ways. With *microbe-images*, by approaching the limit of the catastrophic through the techno-scientific world, it presents the first outlines of a membranous imaginal zone. The visibility no longer comes from the techno-scientific world whose operations are realized through a number of scientific procedures and arrays, shaped according to the logic of algorithmic tools. This world is embedded by a peculiar temporality of the iconic image that has become unified and cannot be reduced to a certain visibility. It is a temporality that embodies its own rhythmicity and acquires its own dimensions in the *inframince*’s thin layer (*pellicule*), which has not yet thought

but has to be thought. The visibility of this type of temporality can be produced only when assumed as an ethical call of speech (*la parole*) and thought (Mondzain, 2009, p. 315). Unlike an imperative ethics of obligations, this is an ethics of calling, and hence, that of the participation and belonging.

* * *

In *Microbiome Portraits*, microbiality is correlated (*rapporter*) to the color aggregates associated within the translation of social acts into images by way of techno-scientific operations. The main issue, however, is how to enter the complexity of the microbial world, to find out there what is irreducible to the categories, assigned functions, or designated identities. The microbe-image is precisely this: an entry into the microbial world, a world not directly associated with the produced color qualities but persists in them, is appropriated by them, and is no longer indistinguishable from the social world. Rather, it sinks the social world into a zone of indiscernibility with the biological, which possesses a form of sociality in its own way. It is not the technical aspects of the portrait that concern the techno-scientific world inasmuch as they are carried into writing by means of representations, but rather the shuddering, jumping, itching, discomforts, or forgotten promises that are waiting to be written with regards to the ethical call of the microbe-images. The colors as reflectors and resonators. Whispers, murmurs, and echoes, which carry the breeze of other worlds, penetrate into the visibilities, and moreover, are the fragile bearing-column of their existence.

The movement we observed in the works of Isitan, from analog to digital, now become reversed in *Microbiome Portraits*, moving from the digital to analog. The image zone is constituted through the play of possessions and depossessions of echoes. As Bardini has stated, “digital beings and analog beings merely *inhabit* the world in different ways, they correspond to different modes of existence” (Bardini, 2016, p. 379). This also means that there are transitions between these two modes of existence. The image zone is a site that is made visible by the artistic techniques in which the transition obtains its visibility as such, as the consistency of the in-between. In this sense, rather than being crystallized in a certain visibility in the iconic image, it collects the vibrations of co-existing elements at the horizon of the catastrophic that functions as a limit. The biopolitical

elements involved in the governance of life vibrate in this zone⁹⁸, which is itself amodal and where different modes come together, fuse, and resonate with each other so as to infuse the singularities in their zone of indistinction. The readability of the world appears at the intersection of the transformation of the potentials of this differential or transversal media⁹⁹. The abstract turns into a field of potentiality. Art becomes the tapping and composition of heterogeneous multiplicities.

Microbiome Portraits summarizes the complexity of the microbial world in the image with the economy of techno-scientific means. However, this complexity does not only belong to the entity designated as microbe but implicates the biopolitical and biomedical processes that define the modes of vitality and of interrelations between living beings. The apparatus of the iconic microbe-image integrates the contemporary techno-scientific conditions and the possibilities of metagenomics, bioinformatics, and algorithmic tools in a biomedical ambiance of the biopolitical processes. Now, what is defined as Nature is this state of fusion, interpenetration or entanglement of factors, the modes of accommodating the unforeseeable in a natureculture continuum. In this respect, ecology becomes economy and the economy ecology. As Bardini puts it, every ecology is a world-ecology (2010, p. 125), therefore a world-economy: the image complexes where the different sorts of complexities are summarized, which are dispersed throughout the medial ambiances in particles as to recondition them.

The iconic is not only an opening, a point of entry to these complexities, so not only a passage point to the imaginal apparatus whose function is limited to strategically put the heterogeneous multiplicities into relation but also operates as “*la puissance adaptative et séductrice de l'économie*” (Mondzain, 1996, pp. 88-89). In this regard, the power of the image does not only conduce to the construction of the truth through the manifestation of the icon and therefore the visibilities (the creation of the intelligible forms with respect to the relationalities). It also lies in the induction of enthusiasms, passions and affects that constitute the very basis of the

⁹⁸ Achille Mbembe's concept of “necropolitics” is crucial to understand how the techniques of governance of life turn into the governance of death in a politics of catastrophism. See Mbembe, A. (2019). *Necropolitics*. Duke University Press.

⁹⁹ For transversal media, see Gansing, K. (2013). *Transversal media practices: Media archaeology, art and technological development*. Unpublished dissertation. Malmö University, Faculty of Culture and Society; for differential media, see Murphie, Andrew. (2004). “The World as Clock: The Network Society and Experimental Ecologies.” *Topia: Canadian Journal of Cultural Studies* 11 (Spring): 117 – 139 .

production of truths. In this sense, just like the synonymy of economy and ecology, the former becomes an economy of the echoes, therefore an echo-nomy. The image zone is an a-modal site hosting intermodal transitions. As modes transversally fuse into each other, what animates the visibility transpires as the audibility (the inner sound of the image). The audible digs the iconic object in the silence of the image zone. This is what actually provokes a thinking process and what is poured into writing. It opens up another kind of readability, and basically “*s’adresse en chacun de nous à ce qui fonde notre adhésion à la vie et à la pensée comme étant une même chose*” (pp. 88-89).

Chapter 5

What Do We Hear When We Hear Microbe-Sounds?

A home hosts different sort of activities. In addition to the obvious structural/architectural effects, how activities are set up in a home and the transitions between them organized also contributes to its ambiance. A home is never a totally closed space. External elements penetrate into the interior all the time. There are also external regimes which unfold into the interior. Now, the music I listen to or hum to myself becomes part of my activity. The texture of the music—its rhythm or tonality—resonates in my mood, the activity I do, the atmosphere of the house. Yet, for a mood to emerge in a musical manner, it is not necessary for one to listen to music. In the execution of each activity, there might be accelerations or decelerations, change in pace, staccato moments, sudden leaps or falls, an overlapping tempo. In other words, our activities are composed of a rhythm and the interweaving of different sorts of rhythms. When I pass from one event to another, what I carry with me is the remnants of these rhythms. An event never starts from scratch. One always starts in the middle. The middle is the rhythm of activities, different types of rhythms intermingling, which constitute a complex of rhythms. Even in the actions I carry out in the most passionate or most ordinary ways, one can find traces of a rhythm. Thanks to these rhythms, I manage to anchor in a certain reality of the world (*fortunately*). It is these rhythmic movements of breathing that brought me to write a doctorate thesis on microbe-artworks and reduced the world to a time frame locked on the study table while also opening the time to a great vastness; contraction and dilatation. Engaging in writing a dissertation is as much a professional preoccupation framed by institutions as it is their abolition on a certain level; the rhythmic interpenetrations of multiple life experiences obscure the boundaries between disciplines to mutually include anxiety and joy. One may hum a song of the worlds, whether the radio is on or off. Multiple world rhythms. World as musicality.

* * *

Certain animals form their world through sound, for example—birds. Birds not only occupy a territory as a result of this evolutionary privilege but also open themselves up to risks in the same move. A thief singing bird may steal the song of another bird and destroy the territory it occupied with a great deal of labor just by singing better. Thanks to phenomena like this, which appear and disappear, we are swept away by curiosities that open us up to the musicality of the world. We are able to dwell on those curiosities thanks to the various research agendas of different fields. Sciences function to accumulate. What they accumulate, however, are bundles of potentials, which trigger fusions with other rhythms. The potentials are revealed by appropriate tools and carry the world's unheard melodies to us. Science is not a simple tool for the sharing of this musicality; it has its own rhythms. When we observe the symbiotic relationship between a wasp and an orchid, this doesn't mean that only a new explanatory scheme has been brought into the repertory of scientific knowledge. This observation manifests modes of relationship, which enable us to think the wasp in orchid and orchid in wasp (Deleuze & Guattari, 1987, p. 10, and *passim*). Thinking is not simply the act of observing this relationship from a distance; in its own way, it is a form of participation in what's happening between the wasp and orchid. By this way, we enter into a becoming. The cosmic dimensions of an event reverberate "inside" us. We can never stay the same.

The Question of Microbe-Sounds

There is also a domain where rhythm gains its audibility: music. For a long time, it was believed that musical instruments imitated natural events. For example, the timbales were thought to be thunder, the piano—flowing water, violins—waves washing ashore. Consider also the representation of animals in music: birds, swans, or crickets. In music, we don't see these animals, we listen for them. Even before thinking of them, we immediately feel them. Perhaps a representation is not just a representation but the production of rhythmic blocks which traverse animality or nature, the emergence of their singular mixes. When we consider our access to these rhythmic blocs only as a privilege of the human world, we miss dimensions of the world that cannot be isolated and designated with respect to something else constructed in advance as having meaning. Seen this way, experience itself would be amiss because its meaning is already located and designated as such. Yet, the house and my presence in it are constructed in one and the same

gesture, that of producing and fusing with different rhythms. In the same way, music—in terms of its processual resources and techniques, opens us up to cosmic rhythms, and furthermore, invents them. Such a fascinating and interesting creature, the music, inventing these rhythms. One arrives at the threshold of the audible, passes through doors, and rhythms the rhythm of the rhythms (*rhythm as a verb*). While the forces express themselves in the various activities of human culture, the human culture relegates its “humanness” to the forces by doubling their expressivity; it is in this doubling that the culture finds its expansion, in the possibility of giving consistency to what escapes from cultural delegation: the consistency of flights: becoming-woman, becoming-child, becoming-revolutionary... Now, rhythmic patterns themselves turn into expression: minerals, plants, animals, natural events until arriving at a becoming-imperceptible. The production of becoming in series, a cosmic tra-la-la.

There is nothing romantic about becomings (or romanticism is a particular way of producing the cosmic tra-la-la). Is it still possible to speak of the Cosmos or have we lost the Cosmos forever (*a discourse of loss*)? From the point of view of the rhythms coming-together, the question becomes more “how” to speak of the Cosmos, not in terms of the *a priori* structures of a harmonious Nature that work as an instance of over-determination but rather as the problem of coexistence of tra-la-las that build time. A tra-la-la is necessarily a multiplicity of different elements. The problem becomes how is it held together with a hyphen, a problem of composition. The problem involves three dimensions of rhythm. The first is the potentializing rhythmic blocks that infiltrate the house (under the form of an interest) and leak from its borders to signal the possibility of a membrane that determines what can pass and what should be inhibited. The second is the rhythmic dimensions of scientific utterance (*l'énonciation*) and the third, its different expressions. With these three dimensions, a problematic field begins to delineate its contours: the beginning of a tra-la-la and its already-heard but not-yet designated expression in writing (*an echo*). The subject is still microbes: microbes and art. The question “why” microbes and art is replaced here by the question “how”. How is the question grounded in sound phenomena?

* * *

We know that the world of animals from time to time operates as a catalyst for thought. Deers, bees, and ants in Jean de La Fontaine’s fables, Jakob von Uexküll’s tick, Franz Kafka’s

vermin, mice, moles, and dogs, Herman Melville's whale, Deleuze and Guattari's orchid and wasp, even Heidegger's animals that don't deserve to die properly¹⁰⁰. Contemporary art theory presents many different animals. We can summarize the relationship between creative thinking and living beings as the movement from minimum knowledge to maximum invention. By this I mean that even a small observation about animals might open the door to creative narration. Kafka's cockroach is a good example. The relatively simple gesture of a cockroach's turning upside down and not being able to get up is an occasion for Kafka to confront the suffocating environment of the family setting and seek fresh air outside it. What gives rise to this journey is not scientific knowledge or fact regarding the anatomy of a cockroach but rather a small observation about its life conditions. It is also possible to find examples in literature where scientific knowledge is integrated into the narrative. In *Moby Dick*, Melville uses encyclopedic knowledge about whales. However, Melville's point is not to develop the appropriate whale form with respect to scientific knowledge or describe their behavior in an objective way in the literary space. Rather, Melville is interested in being opened to a process of becoming-whale that cannot be limited to whale species qualities. In this example, the real catalyst is the striking whiteness of the whale; Melville's whale is not a whale among other whales, it is Moby Dick (*the problem of proper names*), with extra-species singularities that do not fit the average whale¹⁰¹.

The situation, however, is different for microbes. Since the fate of the microbe in the cultural field is dependent on scientific discourses, it assumes in advance an exclusionary logic, one associated with the pathological. It is not easy to conceive of microbes outside the disease context. The experience of disease either finds its conceptual expression in a sort of phenomenology of pain or is conceived only as part of medical devices¹⁰². We have seen in the

¹⁰⁰ History of philosophy offers a rich repertory to think with and through animals. In the first place, Aristotle's amazing work presents a lot of points of entry for thinking of animals that could be (re)problematized under the recent scientific findings. See Aristotle (1991). *History of animals* (Vol. 3). Cambridge, MA: Harvard University Press. For an interesting work on Aristotle's analysis of animals, see Pellegrin, P. (1982). *La Classification des animaux chez Aristote. Statut de la biologie et unité de l'aristotélisme*, Paris, Les Belles Lettres. For a quick revisiting of the conception of animality in the history of philosophy, see Simondon, G., & Chateau, J.-Y. (2004). *Deux leçons sur l'animal et l'homme*. Ellipses.

¹⁰¹ For a striking analysis of animality in literature from a Deleuzo-guattarian perspective, see Massumi, B. (2014). *What animals teach us about politics*. Duke University Press.

¹⁰² For an anthropological perspective on pain, see Breton, D. L. (2016). *Anthropologie de la douleur*. Editions Métailié.

genealogy of the pathological conception of microbes how this preliminary logic of exclusion has been traversed by other kinds of logic (Chapter 2). With ecological approaches, we begin to explore the different dimensions to the relationship between the world and microbes and especially between microbes and the human world through different symbiotic modes. In this way, only after the discovery of different microbial capacities has the issue of microbes concerned different sort of activities in a field extending beyond microbe's objectification in the history of sciences. However, this does not mean that the sciences have lost their importance or relevance in terms of our relationship with microbes. On the contrary, in terms of artistic engagement with microbes, the biological laboratory plays an essential role, for example. Here, the relationship with microbes goes beyond the concern of specialists and becomes an occasion to think and act differently in the world and search for different modes of relationality. This relationship is often described in terms of non-humans in human and vice versa. Sound, as the locus of this reciprocity, constitutes a center of gravity for the experience of microbiality. What so far has been defined as microbiality concerns the potentials emerging under certain conditions from a designated field's framework and their modes of ingress in the world's existing structures and orders. This bi-directional movement of potentials—their emergence and absorption—takes very special form within sound phenomena.

The distinguishing character of sound that creates immediate effects in the listener is what throws us at the heart of microbiality, of microbial event. However, what do we hear in sounds assumed to be related to microbes and what in sounds produced by the help of technical tools or procedures? With the increasing specialisation of sciences, especially in relation to microbe research, the production of microbial sound has become possible by scientific means. Even so, what is it that we hear in this sound, if not an analogy obtained through the refinement of human knowledge made sense by mediation of the human ear? The purpose of this chapter is to place these questions in a problematic framework without falling into aporias that would get us stuck between human speciesism and the bottomless wells of animalism (between reason and feeling, action and passion, order and disorder, receptivity and spontaneity, etc.). In a way, this requires positing the human-microbe relationship in the same continuum and explaining the related sound phenomena, beyond any metaphoricity, as a complex field of relationality that consists of superpositions, twists, deviations, mutations, and passages in this continuum. Here, technical tools or technological meditations thus become not passive vehicles that need to play the role expected from them but can be understood as disparate elements among others settled in the same continuum

in their own ways. They participate in the process of sound production from the angle of their insertion, and in this respect, cannot be *essentially* distilled from the organic world. So, from this perspective, the main problem becomes understanding how these disparate elements come together in a composition. For this, the concept of rhythm will be the privileged angle of attack. But let's discuss it in another introduction (the introduction of the introduction of the introduction, hopefully not *ad infinitum*).

Navigating the Rhythms

As we have seen in the analysis of epidemics presented in Chapter 2, chaos is not simply a lack of determination. On the contrary, chaos is fully determined, just differently than stratified forms. It is defined more by a life activity that creates a crack in these forms as a result of different sorts of forces than the absence of an order. An epidemic, for instance, is not a sublime moment of transcendence of Nature or a certain Totality, which leads to destruction at all levels but a moment of crystallisation demonstrating what microbes can do in terms of their ungraspability by existing social formations. It is through this creative destruction that new meanings, potentials, and modes of governmentality come to fore. We can interpret the ambiance of Ingmar Bergman's film *The Seventh Seal* (1957) from this perspective. The image of the knight who plays chess with the angel of death is not representative of a calculation of the possible paths of action to survive a catastrophe but an ambulating eye that scans the happenings at a moment when the possibilities seem exhausted yet sees the surviving sparks. The chess metaphor may make us think that catastrophic events can be captured within a strategic field. But the ambiance in Bergman's film is so misty that the surprise factor that is defined as the power to disrupt anticipated paths of action now becomes the main factor, emphasizing normality's fragility. Certainly, at some point, the ambiguity of events sediments into the possibility of getting the epidemic under control. At the same time, uncertainty now turns into the possibility of new modes of life (the perseverance of the circus and its capacity of inventing playfulness). A similar dynamic can be seen in microbe-artworks, the implication of playfulness in a catastrophic element. The singularity of the microbe image finds its meaning only at the brink of the feeling of destruction, in a zone where potentials stir. We can only pass under these conditions from the visibility of icon-microbe to the invisibility of microbe-images, in a "conceptual movement" accomplished by the acquisition of a harmonized

feeling of destruction (Chapter 4). It can be said that microbe-sounds are directly related to the sensation of this vital uncanny dimension.

Sound has relative priority over image. Lightning comes before thunder but to hear it we don't need to look to the sky. What is heard is immediately apprehended and the sensation is settled relatively late in the mechanisms of understanding. What do we hear when with the naked ear we listen to what we cannot see with the naked eye? Microbes' invisibility also means their inaudibility. When they are rendered audible as part of a scientific research setting, how should we interpret this? Is it thanks to sciences' capacity to decode the heard microbial sound with respect to explanatory scientific schemes? Or more generally, should we attribute this readability of a microbial sound to a privileged element of the human culture on which the institutions are founded. Is it about technological or cultural mediation that instrumentalizes sound for specific ends?

None of these, however, are enough to explain for the experience of listening to microbe-sounds produced by reference to a certain conception of microbe. Or, if they cannot be explained with regards to any function, should we then call microbe-sounds music? In terms of the operations of sound production, how do the two meanings of the aesthetic—the sensible and artistic as singular coming-together of materials—come together? Here, we come back the “ancient” question of modernist art: who decides what is art? This is followed by the postmodern refrain grounded in the ungrounded, universal status of aporia: anything goes. Is it still possible to evaluate a work of art and its conditions of emergence without introducing *a priori* principles that precede the real conditions of an artwork's production? Without grounding sound in the privileged devices of the human body and its meaning in the structural clusters they operate in conjunction with it, is it possible to address directly sound's dimensions through the operations that produce them?

These questions require removing the metaphorical relationship between microbes and their sound (produced or recorded, depending on the perspective). They must be pinned into a problematic field through the production processes of microbe-sounds. For this task, the *Refrain* plateau in Deleuze and Guattari's *A Thousand Plateaus* (1987) presents a good starting point. *Refrain* posits sound phenomena related to animals and the sound dimensions of the inorganic realm in the same continuum with music but each with their own differences. In *Refrain*, a melody that a child mumbles to soothe its fears as it passes a graveyard, the artistry in a bird song, the composition of classical music, and even professional, scientific, or political refrains that become

various dramatizations of cosmic forces are posited as interrelated modes all part of a certain musicality of the world. In this regard, the proximity between the concept of refrain with the term “echo” in echology can already be felt. The first is the return of difference as the creator of time (differentiation) and the other is the opening of relational dimensions to bring together the continuity and discontinuity with the hit of the sound (resonation).

Different modes of microbial sound production instantiate different conversions of microbially into sound patterns. For example, in the conversion of chemical-physical energies into electrical energy in *Energy Bending Lab* projects, the collection of cellular vibrations in some scientific projects and their conversion into performance in *the dark side of the cell*, and finally, in the microbe-sound compositions of Isitan and Vicki Shannon. The mapping of the emergence of these different modes also presents certain characteristics of ecological approach through the concepts of refrain, milieu, and rhythm.

Biological Rhythms

Rhythms occur at all levels of biological organization, from unicellular to multicellular organisms, with periods ranging from fractions of a second to years. They mostly begin at cellular level and resonate in the entirety of an organism. A group of pacemaker cells dutifully sends out a signal every second or so to drive each heart beat (Goldbeter, 1996, p. xv). In mammals, an egg remains inactive for many years until coaxed into life by a train of spikes triggered by the arrival and attachment of a sperm following fertilization. Liver cells employ the same mechanism to generate calcium spikes. They generate regular pulses of calcium in response to hormonal signals (p. xv). Many other aspects of biological life also exhibit daily rhythms, including “body temperature, urine production, hormone secretion, and skin cell division” (Tyson, 2002, p. 250). Such rhythms, called circadian rhythms, are observed in all kinds of plants, animals, and fungi, as well as unicellular organisms and even cyanobacteria. In humans, cardiac and respiratory functions and circadian rhythm of sleep and wakefulness point to the key role of periodic processes in the maintenance of life.

It would be a mistake, however, to evaluate a rhythm according to a dogmatic measure that would produce rhythmic forms according to a fixed point of reference each time. Deleuze and

Guattari show that a rhythm is not a movement based on a regular or irregular measure (Deleuze & Guattari, 1987, p. 313). A measure might only be the outcome of rhythmic patterns. It is set up according to a codified form and assumes a homogeneity between the supposedly encompassed elements. However, what determines a rhythm is the critical moments; how the measures pass into and articulate with each other, how they inform each other as to be altered altogether, at which moments they lose their cadence as to relate to each other. It is true that rhythm assumes an iterative cycle and its periodicity defined by a certain routine. Yet, it is the non-routine elements at the heart of the system that ensure continuity of the cycle, or as Deleuze and Guattari describe them, heterogeneous blocks. What this means is that, at some point, the functioning of the elements that set up the system through forms of interconnection, which is assumed by periodicity, is interrupted. The system becomes inactive due to its smooth and regular operation. On the other hand, it is at this very moment of inoperativity when the system goes beyond the patterns of activity pre-designed as possibilities that the system is recharged by new possibilities in order to sustain itself. In this respect, it is not the harmonized functional units that define a biological cycle but areal tensions and their resolutions with respect to some disparate elements. Rhythm concerns the passage. While one event is ending, another is about to start. What is transferred between these two events is not predetermined forms but rhythmic blocks, the patterns of interrelations that cross them.

In this regard, intervals in the system reveal the incommensurable nature of rhythm (whose equivalent expression in the plane of thought is the paradox). Although the different elements that make up rhythm are never homogeneous, they form a block in terms of engaging in action together: continuity and discontinuity; operate and cut; register and resonate. A cycle assumes a return of events as it is periodic repetition. It returns but differently each time. A cycle consists of a complex relationship between differential speeds, between the slowing down and acceleration of particles. Therefore, it is necessary to reverse that relationship: what returns in a cycle is not the same forms but the unfolding of a complex of speeds. Paradoxically, while exhausting itself, a cycle develops forms as a reproducibility of the same type of events that characterize a cycle. In this case, a rhythm is identified by tensions and tendencies that precede its equation with the regularly repeated phases of an event. No rhythmic block is subordinate to another. Rhythmic blocks function as complementary heterogeneous layers of an event according to parameters of a tensional field's constitution and its manner of resolution. It hits in passing, establishes the relative equilibrium,

and restores a particular rhythmic bloc under new conditions so as to be articulated to other rhythms as the immanent dissonance of a system. From this perspective, explaining biological processes solely through function, utility, or in the range of the already known structures of meaning, and even the strictly material conditions of the event's occurring would be inadequate. Biological processes implicate an aspect that does not comply with external relations of cause and effect. They incorporate a margin of unexpectedness lying at the heart of the system's characteristic paths of action and reaction as the possibility of capacitation by the access to new potentials. This brings the necessity of understanding the rhythm not with respect to structures that presuppose a unitary form but through a milieu that assumes the interrelationality of elements and their complication within each act of relating.

Milieux and Rhythms

A milieu is not a meta-structure in which organic structures resolve. In other words, it is not a unitary concept. The regular meter of a milieu is a vital pulse not a reproduction of the same, whose regularity and variability are inseparable from the inter-milieu rhythms of difference. In this sense, periodic repetition of the biological milieu produces a rhythm but not by reproducing an identical measure and not in isolation from other milieux. Rhythm takes place between at least two milieux. This is one of the most important points of Deleuze and Guattari's philosophical elaboration of the concept of rhythm (1987). Measure may be regular but rhythm "is the Unequal or Incommensurable, always in a process of transcoding" operating "not in a homogeneous space-time, but with heterogeneous blocks" (p. 385). Rhythm is difference or the relationality of in-betweenness whereby milieux communicate with one another through transcoding or transduction. Each milieu is an array of relations linked to other milieux and the transduction amounts to the non-linear, transversal transmission of rhythmic patterns. Therefore, what returns in each cyclic rotation is not resemblances as the structural reproduction engine of the same but systemic investments where rhythmic blocks gain consistency as the germs of conformity that would be played out differentially. From cellular events to extracellular milieu, to annexed milieu where milieux are held to supply energy, to the associated milieu where milieux have become interrelated, milieux are constituted by the interlocking of smaller and larger pulses and patterns. They are distributed in a landscape in which rhythms wander so as to potentiate themselves by intermingling

with each other. A correlated population of intervals and intervals of intervals is stretched out according to their interweaving from the relatively simpler levels to higher levels, constantly going and coming in-between. Thus, in this relational approach, we find in Simondon and Deleuze and Guattari that the problem of autonomy or domination of disciplinary fields disappears. Fields are both autonomous and not; they are independent of each other, but also require each other at a certain level. The main question then is how the transition is made, based on which middling effect, how the heterogeneous elements come together to make a difference, and as a result, how potentiations appear both in the fields and beyond them (the resonations).

While the transition from physicochemical levels to biological event and organic forms to the social realm now become possible in this non-hierarchical way, one can find the explanatory schemes in each field accordingly. The causality chains are implied but also point their beyond, retrospectively graspable by proper conceptual tools. In biology, this happens with the discovery of feedback-feedforward processes that disrupt linear causality. In terms of biological rhythms, the oscillations explain how the interconnections between milieux are effectuated. By means of some spontaneous oscillators, the codes of milieu pass into each other and a rhythmic metamorphosis take place. Rhythms of rhythms (just like the introduction of introduction of introduction, not *ad infinitum*, but in the middle).

Many organisms possess an internal rhythm that dictates different behaviors at different times of day. These behaviors range from “the cyclical change in metabolic enzyme activities of a bacterium to the sleep–wake cycles of humans” (Alberts et al., 2015, pp. 876-877). Having a circadian clock enables an organism to anticipate regular daily changes in its environment and take appropriate action in advance. Periodic changes in physiological properties, such as physical activity, body temperature, reproduction, etc., are “entrained” to the 24-hour cycle of light and darkness. As a result, the internal clock cannot be perfectly accurate and so it must be capable of being reset by external cues such as daylight. Thus, circadian clocks keep running even when environmental cues (changes in light and dark) are removed. The period of this free-running rhythm, however, is generally a little less or more than 24-hours. External signals indicating the time of day cause small adjustments in the running of the clock so as to keep the organism in synchrony with its environment. Remarkably, in almost all multicellular organisms, including humans, “the timekeepers are individual cells” (pp. 876-877). A specialized group of brain cells

controls our diurnal cycles of sleeping and waking, body temperature, and hormone release. “The suprachiasmatic nucleus (SCN cells) receive neural cues from the retina, entraining the SCN cells to the daily cycle of light and dark” (pp. 876-877.). They also send information about the time of day to another brain area—the pineal gland, which relays the time signal to the rest of the body by releasing the hormone melatonin in time with the clock. Although SCN cells have a central role as timekeepers in mammals, almost all the other cells in the mammalian body have an internal circadian rhythm. For the regulation of this cellular process, oscillations become inevitable in a highly complex, multicomponent biochemical pathway, due to the large number of feedback loops. The regulatory mechanism for a protein called “PER synthesis contains a time-delayed negative-feedback loop” (Tyson, 2002, p. 232). The key principle here is that circadian clocks generally depend on negative feedback loops. These loops in-between the rhythmic oscillations in a circadian clock felt in the entirety of organism cause spontaneous oscillations which “only exist in nonlinear dynamic systems and persist with finite amplitude” (Kruse & Jülicher, 2005, p. 21). As Ilya Prigogine points out in his introduction to Albert Goldbeter’s book *Biochemical Oscillations and Cellular Rhythms*, spontaneous oscillations are highly complex and constrained by non-equilibrium systems (Goldbeter, 1996). Spontaneous oscillations reveal at the same time “limit cycles, steady states, chaotic behavior [...] without any emerging universal scheme” (Prigogine 1996, p. xxi, in Goldbeter, 1996).

A negative feedback loop contains delay mechanism that slows down the feedback signal through the loop: “rather than generating a new stable state as in a rapid negative feedback loop, a delayed loop generates pulses, or spontaneous oscillations, in the levels of its components” (Alberts et al., 2015, p. 516). This can be seen, for example, if the number of components in a negative feedback loop increases, which leads to delays in the amount of time required for the cycle of signals to be completed. This event basically takes place at intracellular level through the signaling process of proteins if a specific protein inhibits its own activity with a long delay. Secondly, the same kind of spontaneous oscillation arising through a delayed negative feedback can be observed throughout “gene transcription in *Drosophila* and many other animals, including humans” (p. 516). For instance, the heart of the circadian clock is a delayed negative feedback loop based on transcription regulators. Accumulation of certain gene products switches off the transcription of their own genes, but with a delay, so that the cell oscillates between a state in which the products are present and transcription is switched off, and one in which the products are

absent and transcription is switched on. The negative feedback underlying circadian rhythms does not have to be based on transcription regulators. Changes in the parameters such as “binding affinities, transcription rates, or protein stabilities” can change the amplitude of a delayed negative feedback loop and period of the oscillations (p. 516). These versatile mechanisms generating all sorts of oscillators can be used for various purposes in the cell. However, not all of the oscillations observed in cells are thought to have a function (Alberts et al.). Rhythm would repeat itself just as in other cycles. If a spontaneous oscillation doesn’t have an apparent function in the process of constitution of a circadian rhythm, but only occurs in the crack opened by this event, it must have something to do with the existing temporal structure breaking through to the event. Now, the future is radically open without having been actually determined yet by the previous occasion. A vital activity then cannot be encapsulated in either the overall organization of the circadian rhythm occurring dependently on the internal and external conditions of related cells in contact with the environment nor through regulation of certain lively activities in the negative feedback process. Vital activity finds the condition of its operativity in its inactivity, in other words, in the delay. It is in these spontaneous oscillations that the delay can be felt by cells. It is the network of molecular relations, controlled by positive or negative feedback loops and driven by a flow of matter that contingently gives rise to periodic or chaotic behavior. This kind of processual perspective to biological rhythms brings a kind of immanent causality to all entities and their relational structure in an interconnected fashion rather than imposing categories from an extrinsic perspective of understanding.

The Music of Life

Biologist Denis Noble calls the processes of complexification and coordination of life at different levels the *Music of Life* (Noble, 2006). Noble proposes a “downward causation” against genetic determinism in order to explain these processes beyond linear causality. Accordingly, downward causation works in both ways. Cellular events contain a margin of spontaneity resulting from microscopic stochasticity, which can then generate a major change in genome and phenotype. At the same time, as in systems-biology approaches, the biological processes as integrated systems at higher levels cannot be reduced to lower-level databases like the genome (pp. 1-22). For this reason, downward causation is not simply a reversal of deductive logic or its replacement by either

induction or their functioning together in harmony. Instead, it is a totally different level of causation, which—as Noble explains in reference to plant geneticist Enrico Coen’s approach, requires being placed at the level where genetic instructions and processes are carried out as inseparable, where plan and execution mutually include each other (Coen, 1999; Noble, 2006, 2016). Noble injects a dose of Lamarckism into genetic approaches and develops an understanding of Nature as working through cracks. Inherited forms of genetic order are the dispositions in which vital investments find their consistency in genetic arrays and functioning. They express the mutability of vital functions as a potential of adaptation. A potential, differently than a possibility, expresses unexpected expansion of living beings’ organized faculties spectrum. Sensibility, perception, or understanding can find their alteration only in the cracks that gesture a beyond genetic determinism. These cracks might also lead to great fissures that bring significant changes to inherited patterns as they might lurk in the fuzziness of vital processes’ boundary conditions. Boundary conditions define what constraints are imposed on a system by its environment and can therefore be considered as a form of downward causation. The higher levels in biological systems exert their influence over the lower ones. Each level provides the boundary conditions under which the processes at lower levels operate.

For this reason, in terms of the functioning of biological processes, what matters is not the determination of species in a classifying regime or even the interspecies modes of functioning. Rather, what matters is the intermediary situations where levels and layers mix with each other and the membranous surfaces that accommodate them. As Noble says based on Cavalier-Smith’s concept of “membranome”: “much of the logic of life lies in its delicate oily membranes” (Noble, 2012, p. 58). Reference to music or dance in Noble’s book with respect to biological processes gains meaning at this point. The complex interplay of genetic sequences, genes, proteins, macromolecular complexes, signaling networks, adaptive and regulatory functions, species, communities, in brief—a whole ecology consists of complex interrelations. Now, life turns into a kind of music, a symphonic interplay between genes, cells, organs, body, and environment (Noble, 2006).

Deleuze and Guattari offer that the multiple transductions which traverse vital processes don’t simply add another element to the system’s functioning as an integrated aspect according to spatiotemporal coordinates (extensionability of elements). Instead, these processes can now be understood as constituting a whole new plane as the emergence of a new value, injecting new

pathways, passages, tunnels, and crossroads (intensive interrelatings) (Deleuze & Guattari, 1987, p. 314).

Microbiology or microbiome studies in general deal with huge diversity of facts or pieces, constantly offering new complex patterns to describe evolutionary processes (Baquero, 2004, 2009, 2011; Wagner 2012). Depending on the circumstances and food supply, an organism is able to play a whole repertory of action-reactions in different tunes. For example, according to one of the forerunners of microbiome research—Rob Knight, the gut microbiome works like a large-scale ecosystem in which different groupings of microbial species can carry out different functions in an orchestrated way (Mayer, 2016). The orchestration of units does not necessarily mean that they are articulated with each other in a harmonious or pre-established way. Rather, this orchestration implies that even the dissonances always a part of the biological process that define their eventfulness as seen with spontaneous oscillations in circadian rhythm, tune into each other in the interpenetration of different speeds (rate of rhythmicity). A group of microbes competes with other groups in order to gain territory and resources as much as they cooperate with each other. Microbes don't have a nervous system, yet “have varieties of perception, memory, communication, and social governance” (Damasio 2019, p. 54). Their functional operations are basically shaped by chemical and electrical networks that give rise to leveling and layering among different biological processes. The continuous execution of vital activities induces changes of pace, rhythm, and key, the interweaving of pulsations with non-pulsed beat. Each species participates in this never-ending background music of life through their own modes of feeling (Habibi & Damasio, 2014; Sach, Damasio, Habibi, 2015).

The production of microbe-sounds with different interests and ends, how we listen and engage with them in various ways belongs to this expanded field of feelings. Microbial rhythms are captured according to whatever techniques and operations are put into use, and accordingly, are transformed into a sound that can be heard by the human ear. In this way, the rhythms of the microbial field, technical tools, and the human ear come together to produce a complex interplay of rhythms.

Interspecifics Collective

Interspecifics, a bioart collective based in Mexico, explores communication dynamics between different species through sound phenomena. “*Interspecifics*” means “arising between

species” and what arises between species here is the different vibratory regimes produced by electro-chemical activities converted into sound compositions by specifically designed interfaces¹⁰³. Members of the group produce different tools depending on the requirements of the project at hand. They gather these tools and the logic of production under the title of *Energy Bending Lab*. The lab is comprised of a set of custom-built modular synthesizers and tools that help to convert accumulated electric properties found in bacteria into real-time sonification. *Interspecifics* appeals to a series of transduction in the literal sense of the term: the conversion of a signal from one medium to another in which sound travels through different material environments. But this technical meaning of transduction also converges with its philosophical meaning in the sense that sound phenomena are not simply quantifiable raw matter passively transferred from one medium to another in a linear way. Rather, they are rhythmic patterns that undergo qualitative transformation within each transductive operation. The main emphasis of the collective is to discover these emerging rhythmic patterns through multimodal formats. The relationship between waveforms, matter, and frequencies’ physical form finds its expression in the patterning of data values through critical turns of oscillations. We could summarize the work of *Interspecifics* as experimentation with non-human worlds (comprising both microbes and technical tools) devoted to exploring these participatory modes through sound compositions.

In *Micro-Rhythms*, the collective aims to capture small voltage variations inside microbial cells. The cells are sampled from the soil¹⁰⁴, where harmless bacteria are isolated and grown in a laboratory environment. The micro signals produced by the bacteria is then amplified so that the micro voltages can be converted into electronic signals. These signals are introduced as data into a pattern recognition algorithm that matches the oscillation sequences to be turned into sound. Finally, a Python algorithm and three Raspberry Pi cameras with Open Computer Vision are used to track light changes and create a real-time octophonic audio system score played using a SuperCollider¹⁰⁵. In this way, the installation creates an audiovisual system, which converts the bacteria’s metabolic oscillations into integrated rhythmic blocs perceivable by the human ear with an organic quality to the music. As Antonio Damasio explains, a metabolism is the name of the rhythmic cycling of cells’ chemical pathways as they extract the necessary energy from their

¹⁰³ <http://interspecifics.cc/work/>. Accessed 20 June, 2020.

¹⁰⁴ <http://interspecifics.cc/work/micro-ritmos-2016/>. Accessed 20 June, 2010.

¹⁰⁵ <http://interspecifics.cc/work/micro-ritmos-2016/>. Accessed 20 June, 2010.

environment, use it as efficiently as possible, and then throw away the waste products (2019, p. 34). Each of these operations requires a number of integrations and differentiation processes in which the concept of transduction finds its meaning. According to Simondon's elaboration of the concept, the affectivity of a living being, at some moment, holds the information acquired from its environment in a reserve according to the given circumstances in order to integrate that information into its system in order to ensure a continuity or a relative stability (Simondon, 1964, p. 142). In another moment, the acquired energies are gradually distributed in a differential way according to the capacity of accumulation of different parts. Finally, this means that at each of these moments and at each level, the transducers are triggered in accordance with the intensity of affectivity leading to a cascade of events affecting the coordination of the whole system. In *Micro-Rhythms*, what is perceived by the human ear as changing rhythms giving quality to sound is this process of integration-differentiation actualized by multiple transducers, each time individuated according to specific circumstances in the soil, petri dish, bacterial groupings and conditions of growth and the designs of the algorithms, cameras, and audio-visual system. These disparate elements are then brought together in the form of audiovisual installation.

In the work of the *Interspecifics* collective, aural effects implicate their potentials beyond instrumental purposes toward the creation of interactions designed to attune human perception to non-human elements. Each installation's interface design plays an important role in actively contributing to the work's eventfulness as a nexus for the generation of rhythmic time. In the process, it crystallizes potentials beyond spatialized connotations (Ikoniadou, 2012, 2014)¹⁰⁶. Meanwhile, in *Nonhuman Rhythms*, an unnoticed aspect of urban life, unnoticed but somehow experienced in the spatiotemporal coordinates of daily life, is brought to the fore. The collective gathers water and sediment from the nearest shore to the exhibition site in order to build a microbial fuel cell and signal amplifier that will transduce the microbial vibrations captured through the collected samples into sound¹⁰⁷. To monitorize the bioelectric signals, *Interspecifics* uses programming tools *Processing* and *Pure Data*, and *Open Computer Vision* to analyse the

¹⁰⁶ Manuel de Landa also discusses the shift from input-output to agent-driven interfaces, implicating as he puts it the notion of the interface as event, in "Meshworks, Hierarchies and Interfaces" (in John Beckman, ed., *The Virtual Dimension: Architecture, Representation and Crash Culture*, New York: Princeton Architectural Press, 1998, pp. 274-285).

¹⁰⁷ <http://interspecifics.cc/work/non-human-rhythms/>. Accessed 20 June, 2020.

movements under the microscope. The bacteria, when deprived of oxygen, reduce metals from their environment and in the process grow nano antennas used as an electron transfer respiratory tube¹⁰⁸. A conversion of frequencies emerges from this relationship between bacteria, oxygen, and metals captured by the various tools sensitive enough for their capture.

In *Nonhuman Rhythms*, elements pertaining to soil, water, weather, plants, bacteria, fungi, electronics, and humans are co-composed as traversing the dynamics of each element but translated as transducers of energies and flows, changing character with each operation. The gently shuffling rhythms and persistent electronic rattles, beeps, and interruptions of the work intertwine in a complex ecology of speed in what Eleni Ikoniadou calls “rhythmic time”; this rhythmic time passes through diverse elements or transducers, pointing toward a capacity beyond the already established and settled temporalities couched in a specific field of activity through its functionalities and affordances (2012, p. 263). The growing feeling of uncertainty in the work indicates the existence of complex rhythmic patterning which vibrates “beneath solid structures, organized structures, organized spaces, specific spatiotemporal dimensions, peoples and events” (p. 272). This patterning is mainly achieved through electrical energy, which is derived from the physical-chemical activities of the microbes. The environmental conditions that determine the acquisition of electrical energy are effective in the emergence of frequencies and oscillations. While all of these factors are distinguishable in extension as separate entities, they are involved in the formation of the singular quality of sound as disparate elements, evoking themselves as echoes in the eventfulness of the experience. Which soil, what kind of bacteria and algorithms come together and what kind of discursive intervention ensures the involvement of the participants?

Although the answers to the above questions pass through the experience of listening to the sound, they become meaningful only through the production process of the microbe-sound itself and the way microbially is produced. This experience activates the human ear as a separate cultural factor, implicated in the work. The human ear, beyond being a coding tool that perceives changes in sound patterns, can be said to come down to the form of a question in its role in the process to bring together the elements that traverse the composition. Thus, nonhuman rhythms

¹⁰⁸ <https://todaysart.org/non-human-rhythms/>. Accessed 20 June, 2020.

resonate with the philosophical concept of rhythm. In the following example, we will see that the human ear plays a different role in terms of microbe-sounds produced in a scientific setting.

the dark side of the cell: Cellular Noise or Cellular Music?

The second microbe-sound example, *the dark side of the cell*, an audio-visual installation realized with the collaboration of Anne Niemetz and Andrew Pelling, concerns microbial sound production produced directly within the scientific framework that can be posited within a specific research program or lead the way for asking new scientific questions. According to a technique called sonocytology, vibrational movements of cell walls can be recorded by the aid of a scanning probe microscope and amplified in order to render them audible to the human ear (Roosth, 2009). In this technique, the cellular vibrations are then converted into cellular sounds that can be interpreted as conveying meaningful information from the mobilized scientific point of view. James Gimzewski, the (bio)chemist who discovered this technique, calls the sounds captured as a result of sonocytological procedures “music” since they are not just random noise but help to produce scientifically meaningful results and are articulated in a harmonious way. As well as being part of scientific research, these sounds were exhibited as an art-science performance under the title—*the dark side of the cell*¹⁰⁹. Is it enough, however, to qualify a sound as music or art, to associate it with meaning or produce distinguishable rhythmic patterns recognized by the human ear? The problem is how to pose this question without assuming an *a priori* principle that doesn't predetermine what the work can do. For this, it is necessary to take a closer look at the conditions of production of *the dark side of the cell*.

In order to understand the production of a microbe-sound through sonocytology, which brings a certain melody of life, we can once again appeal to the concept of transduction. The most important aspect distinguishing Simondon's concept of transduction from its technical meaning as the translation of signals across various media is the emphasis on the amplificatory processes. Simondon posits that each process of transduction necessarily involves amplification. The disparity between the elements coexisting within a field of interaction creates a certain tension according to the distribution of polarities. Transduction basically concerns the resolution of this tension. This process culminates in the emergence of an extra-effect that cannot be either reduced

¹⁰⁹ <http://www.darksideofcell.info/installation.html>. Accessed 23 June, 2020.

to a single privileged element or forecasted as having a definitive form. This means that translation across series, that is—the transition of a signal from one medium to another or the effects of elemental forces distributed in the same field, cannot be explained according to a linear unfolding. The participating elements, despite being disparate, operate in solidarity. Their coming-together itself is a taking-form, which means that it is a process of invention (where the concept of ontogenetics finds its meaning as the genesis of form).

The sonocytological operations that render possible *the dark side of the cell* consist of a series of biological and technical transductions. The recorded sound is not only the capture of cellular responses to some extracellular circumstances (cytoplasmic events) but also a produced effect which demonstrates cell wall porosity, blurring the boundary between intracellular and extracellular milieux. The sound shows that each response or resolution enters into a process of capacitation projected into specific regimes of vibration. The specificity of this regime depends on the constitution of the porous structure as a site of resonation emerging from the disparate elements, kept in suspense and tensed towards their resolution. All this to say that the technical tools that enable the translation of biological information into electrical impulse, in a sense, represent a field of sensibility which collects the rhythms of the field of elemental interactions. Each use of this technique is a process of form-taking and brings an amplification in its functioning site as the capacitation of the system. Conversion of the input energy into output energy by an atomic force microscope, rather than being a gradual development of an already pre-designed all-encompassing structure as a staging of pre-established trajectories, instead translates a series of vibrations through different transductions. In this regard, this process of translation explains why we hear a musicality (harmony) in the produced sound, even from the scientific perspective. The recorded sound doesn't only provide access to the workings of the cellular interior by indexically signifying cellular metabolism and movement and in this way, appearing as a technical tool for the advancement of scientific research. Through the dispersion of sonic height, depth, and directionality, it also opens an auditory space. The recorded sound performs a rhythmicity involved in the interactions between milieux, exterior, interior, intermediary, and annexed milieux, finally implicate the technical transductions of associated milieu. The vibrations are conditioned by intra-, inter-, infra-cellular processes unfolding in cytoplasmic milieux; they are “the busy hum of actin and myosin filaments assembling cellular scaffolding, the whoosh of molecular transport through cytosol, the glub glub of endocytosis and exocytosis” (Roosth, 2009, p. 347).

A tension and mutual feeding arise here between the signifying regimes of scientific activity and the meanings that emerge through the resonance of a multiplicity of milieux. It is this tension that conditions the echoes between scientist and technical tools, scientific findings and extra-scientific interests. The complexification of the regimes of passage relativizes the duality between exterior and interior and makes, as Deleuze in his Simondonian-inspired analysis of Foucault puts it, “*d’un dedans qui serait seulement le pli du dehors, comme si le navire était un plissement de la mer*” (Deleuze, 1986, p. 126).

In order to think about collectivity without falling into any substantiation, Simondon’s departure point for creating the concept of transindividual is the interpenetration and mutual productivity of outside and inside (Simondon, 1989, p. 156; Combes, 2014, pp. 35-39). In this interpretation, the subject no longer has an *a priori* form in which an assumed externality is turned into the categories of an interior through representations, nor is it an arbitrary moment of a presupposed external world. The subject now emerges as a result of a process of subjectivation, at the limit of an inside and outside. The process is overloaded with potentials and capacities in such a way that the actual forms cannot be delegated to involvement of different factors and their interactions with each other. Simondon calls this margin of uninvested potential the preindividual and constructs it as the absolute openness of the future as the presence of inactuality in actuality. The two meanings of the -trans prefix in the trans-duction come together at this point: being traversed and moving beyond. This means that neither does objectivity—assumed by scientificity, leave the world in a rigid (*figé*) state, nor are the rhythmic movements captured through it temporary, not-yet-consistent personal or individual investments. Between them, there are echoes, not in the sense of relativity of individual perspectives but that of the being of relation, which conditions the passages between different modes beyond the established terms. Now, the “we” used in previous chapters either in terms of scientific discursive formation or relating to the implication of microbe-artworks in different tracks can be understood in this transindividualist sense: the emergence of a potential resonance with the eventfulness of individuations and the possibility of relating it to other fields.

Sonology, in this regard, brings into view the interface of this echoic transitivity established in a specific scientific formation.

* * *

Conversely, in the scientific context in which sonocytology was installed, we find typical extensions of the production of scientific knowledge process also in the production of microbe-sounds: the translation of biological processes' dynamics into possible medical applications. The structure of recorded sound might provide access to cell functioning by signifying cellular metabolism and movement. As such, the frequency difference between vibrations at higher or lesser degrees might index the difference in the ATP metabolization speed therefore helping to distinguish between cancerous cells and noncancerous cells (Roosth 2009, pp. 340-341; see also Thompson, 2014). In this way, sonocytological procedures could be used as a diagnostic tool in order to detect cancer at an early stage. Perhaps this is the most important point distinguishing *the dark side of the cell* from a musical piece. Not simply because its design is primarily devoted to scientific tasks but as a matter of consistency. Can recorded sound keep the tension specific to the coming-together of disparate elements in a sufficient degree of consistency? To what extent are the qualitative feelings of the rhythmic blocks and their intermingling felt in the experience of listening? Or, is a particular mode of microbiality not reducible to but primarily defined by elements of scientific schematization through functions and significations predominantly felt? Although each form emerges as a result of a process of taking-form and through the scientific techniques and procedures we access the eventful phases of this process and its rhythmic movement, to what degree do these forms maintain their dynamics? We can trace the contours of these questions through two microbe-artworks that are not part of a scientific project.

The Refrain of Microbe-Sounds

In *Refrain*, Deleuze and Guattari (1987) present a genesis of music, which traverses all realms of being. The theme or concept of refrain (*la ritournelle*) is not only about music however. There are also literary, scientific, artistic, or professional refrains¹¹⁰. Previously in this chapter, the name given to the refrains' implication in every kind of activity was a "cosmic tra-la-la". It is a tra-la-la because in each activity there is a musicality in the sense of specific interweaving of

¹¹⁰ Scholars are interested in this chapter for the problem of music. See Bogue, R. (1991). *Rhizomusicology*. SubStance, 20(3), pp. 85-101; and Jacques, V. (2005). Le monde de la musique et la musique comme monde selon Deleuze. Horizons philosophiques, 16(1), pp. 1-23.

different rhythms. It is cosmic because when that rhythmicity is pushed to its limits, it becomes unidentifiable in terms of any territory existing in the world (*deterritorialization*). Whenever an event begins (*tra*), develops (*la*), and ends (*la*), there is the destiny of a refrain: to return and restart (*ritorno, ritornara*) and to bring a difference with each new beginning. A teacher distributes exam papers in a class; a student tries to write a doctorate thesis (*as if it is his business!*), a leaf falls into the water; a lion roars; lightning strikes somewhere.... with each moment, a small melody of the Cosmos is emitted. Deleuze and Guattari approach the non-musical dimensions of the refrain through the problem of territory in animals. They extend the concept of refrain to the example of singing birds and problem of the origin of music.

Meanwhile, there are also examples that do not directly concern music. In Marcel Proust's *À la recherche du temps perdu*, "Vinteuil's little phrase" instantiates how the refrain works in literature (Deleuze & Guattari, 1987, p. 319; Guattari, 2011, pp. 408-442). The phrase is initially associated with Swann's love and functions in a network of significations in connection with Odette's personality, Boulogne's landscape of forest, etc. But this phrase haunts Swann. He keeps remembering it and becomes obsessed with it because of its musicality. The phrase, by its insistence, returns into itself, suspends the already known connections and opens into unheard potentials. Swann moves beyond the already existing territories that establish his existential coordinates; within the terminology of *A Thousand Plateaus*, a deterritorialisation takes place. The phrase that is now "*porteuse d'aucun message, d'aucune information discernisable*" turns into an event (Guattari, 2011, p. 426). Swann enters into a process of becoming which he traverses in series. From Swann's singing to the Dreyfus affaire, different components echo each other (pp. 422-423). This means that musicality does not only concern sound but shows itself in different activities, or inversely, one can find a certain type of musicality in each event¹¹¹. A refrain is the

¹¹¹ Whenever there is a problem of critical distance, then there emerges a problem of territory and refrain (and echo): "In animals as in human beings, there are rules of critical distance for competition: my stretch of sidewalk" (Deleuze and Guattari, 1987, p. 321). For this reason, in almost all fields, there might be found some examples. Example from cinema: *Istanbul Echoes* (2017), a film of Montreal based movie-director Giulia Frati. Example from literature: Maylis De Kayrengal's *Corniche Kennedy* (2008). Another example might be about walking, and the rhythmic passages between walking and thinking. "The rhythm of walking generates a kind of rhythm of thinking, and the passage through a landscape echoes or stimulates the passage through a series of thoughts. This creates an odd consonance between internal and external passage, one that suggests that the mind is also a landscape of sorts and that walking is one way to traverse it. A new thought often seems like a feature of the landscape that was there all along, as though thinking were

unfolding of a temporality, independent of an *a priori* structure: “Time is not an *a priori* form; rather, the refrain is the *a priori* form of time, which in each case fabricates different times” (Deleuze & Guattari, 1987, p. 349).

Microbe-sounds establish a microbial temporality through the apprehension of a refrain that goes from and through scientific formation. How this temporality is constituted depends on the composition of the work, that is—which elements come together and how.

Günes-Helen Isitan’s *Microbiota’s Song*

One of the most known methods used for observing the reproduction of microbes is to record their growth in a petri dish with a microscope and to make it possible for the human eye to perceive the development stages with the help of time-lapse. In *Microbiota’s Song: The Poetry of a Tongue*, Isitan adds to this method the dimension of sound. In this project, where microbiology, photography, video, and sound design come together, microorganisms live together with humans mostly in symbiosis, as seen in most microbe-art projects.

In *Microbiota’s Song*, for the above insight to be transformed into artistic form, samples are taken from the human tongue and grown in a petri dish. This process is recorded for 180 minutes and then converted into a three and a half minute time lapse video¹¹². These images are then combined with photographic images obtained by microbial samples developed on photographic film. In this way, the movements of microbe growth activate the photographic film images and turn into lines that appear, grow, distribute, mix, or overlap in color. In the last stage, depending on the growth rate of microbes, a soundscape is created with the help of a generative sound program, which is activated by the color patterns. The tempo varies in accordance with the speed of growth in relationship with the changing color and movement patterns.

We have seen that scientific activity portrays microbial temporalities through vibrations and oscillations. The rhythmic blocks comprehended over the change values gain meaning according to metabolic mechanisms and the recorded sound is conceived through them. In *Microbiata’s Song*, the focus is not on the cell’s interior functioning but on the collective agglomeration of the passages between milieux and their articulation through image and sound.

traveling rather than making” (Solnit, R. (2001). *Wanderlust: A History of Walking*. Penguin Books, pp. 5-6). Thanks to Marianna Milhorat for bringing this book to my attention.

¹¹² <https://www.gunesisitan.com/microbiota-s-song>. Accessed 25 June, 2020.

This leads to a rhythmic temporality consisting of, in the words of Ikoniadou, “unknown, indeterminate, and unintentional forces immanent to the sonic” (2012, p. 261) that the “transitory glimpses... endure in consciousness, or express in language, but which are vividly real in their effects” (2014, p. 142). And so, the question lies right here: to what extent might these “transitory glimpses” articulated between sound and image endure in the artistic interface?

For Deleuze and Guattari, the problem of art emerges precisely at this point: how to determine the degrees of consistency or consolidation of an artwork without an *a priori* criterion whose determination precedes the artwork, which depends on its capacity of appropriating expressive qualities. The whole point of an artwork related to sound phenomena is to render inaudible sounds audible. The two obstacles for this are the possibility of the sound remaining at the level of “reproduction machine” or there being too little distinguishability in the disparate elements of the treated materials and thus the form’s homogenisation. In both cases, the produced sensible form’s intensity would not be felt sufficiently, and for this reason, the work’s potentials would remain inaccessible.

For microbe-sounds, this concerns the problem of the molecularization of microbe, of consolidating, in some ways, the microbial rhythms with scientific formations, which remain at the fringe of scientifically consolidated microbial rhythms. To what extent can a refrain derived from the significations reached as a result of scientific procedures and techniques escape from these significations? It is due to the proximity of collectivity in the sense of transindividuality to the sound phenomena beyond a metaphorical relationship that a refrain collects itself in the effects of compositions. The echoes find their meaning at this conjecture of the preindividual and transindividual, at the interface of the artwork. Dissonant, but still harmonious. Divergent, but still converging. We arrive at three modes of thinking and the echological regions into which they sink within their singular type of activity: science, art, and philosophy. The world we launched with an echo. Minimum microbe, maximum microbiality.

Vicki Shennan’s *Anthropocene*

In Vicki Shennan’s *Anthropocene*, once again through the intersection of the biological and computational, we arrive at a point of microbialty’s going beyond the meanings that arise within scientific formations. Different types of microbes in the human body interact with each other and with the mechanisms part of the human organism. These interactions vary depending on which

area of the body is concerned (especially skin, gut, and tongue), environmental factors, or factors related to lifestyle such as diet or physical activity. DNA sequences can be isolated through samples taken from a body part by the aid of computer software-algorithms that translate them into an identification of the species of bacteria. Then, the genetic code of microbes may be translated into protein structures, encoded by the same DNA or RNA letters. On the other hand, there is always a distance between the environment from which microbial samples are extracted and the various coding mechanisms that explain the sophisticated machine of a cell. Shennan's *Anthropocene* turns these encodings into melodies and melodies into a symphony with which they relate¹¹³.

In *Anthropocene*, everything works as if it were a process of scientific research. First, Shennan translates DNA sequences into musical notes. Each DNA letter represents one note. The three-dimensional (3D) digital reconstructions of the proteins are then extracted from the microbe samples. Using data from X-ray crystallography—a technique that determines the spatial disposition of the amino acids that compose the protein, the computer assigns note sequences to specific 3D features of the protein¹¹⁴. Through these forms, the notes and melodies are constructed with the letters this time corresponding to RNA codes, and these are overlapped with the DNA-linked melodies placed in the background as a separate layer¹¹⁵. In this way, recognisable musical note patterns emerge from the 3D structural data and DNA coding. The characteristic patterns of protein structures such as helixes are heard as arpeggios and beta-sheets as a succession of similar notes in order to produce repetitive patterns, changing in rhythm, melody, and intensity throughout the piece. The ways in which the genetic code of nucleotides or the shapes of protein are translated into sound patches are incidental but not metaphorical, organized but not preordained.

¹¹³ <https://victoriashennan.co.uk/Anthropocene-Microbial-Music>. Accessed in 27 June, 2020.

¹¹⁴ <http://yourwildlife.org/2015/06/the-value-of-art-to-science-a-story-of-rotting-bodies-belly-buttons-and-the-music-of-symbiosis/>. Accessed in 27 June, 2020.

¹¹⁵ A series of melodies derived from the proteins produced by the microbes plays. To do this, Shennan collaborated with Dr. Linda Long, a biochemist at Exeter University who developed a method to generate music representing the 3D structure of proteins. First, Shennan “translated” short DNA sequences into notes with the help of a composer, Jack Hurst. These notes represent the DNA four letter codes, each with its own tone. Separately, Shennan worked with Dr. Linda Long who produced the common skin microbes (proteins encoded, of course, by the DNA of those microbes); the shapes of those proteins were then turned into swooping melodies which were layered over the DNA background (for more on Linda Long’s approach, see: www.molecularmusic.com)

The resulting melodies are obtained by the extraction of DNA and RNA sequences, by their conversion into data, and their attribution to the musical notes in a contingent way. On the other hand, this echoes a deeper contingency, which traverses vital processes and their rhythms, and, consequently, their consolidated phases beyond contingencies. The molecularity of microbes escapes from the functioning of structurally interconnected sub-parts, automatically triggered by a Central Unit. It is the microbial molecularity in relation to molecular populations that are coordinated according to each other through multiple centers, which consists of “an articulation from within, as if oscillating molecules, oscillators, passed from one heterogeneous center to another, if only for the purpose of assuring the dominance of one among them” (Deleuze & Guattari, p. 387).

In this regard, instead of seeing the process starting with species determination and moving to sound production as linear, the process can be considered as the unfolding of formative themes following Raymond Ruyer’s proposition defined by “rhythmic themes and melodies” (Ruyer, 1958; Deleuze & Guattari, 1987, p. 332). The techniques for determining and classifying species are known in advance. But within each process, in the sense that the specific way and purpose of classification comprehends an unknown, one submerges into a field of potentials. In this regard, a rhythmic or melodic theme precedes its own execution and is identified through a refrain’s consistency. At the same time, we have seen that a refrain itself consists of the consolidation of rhythmic patterns, where its capacity of enduring and creating time arises. A sort of mode of memory, a “mnemic trace” (Ruyer, 1958, pp. 113-15) conserves itself as to be reactivated with the stimulus to which it is attached and sensible. In this regard, Ruyer’s approach to life both harbors a structural aspect that precedes actualization and implicates an absolute uncertainty to be determined according to the unfolding of the mnemic trace. A formative theme activates itself according to a multiplicity of factors, is twisted by singularities, or in Simondonian terms, is modulated in accordance with the field it is implicated (Simondon, 2005).

From this perspective, artistic engagement with microbes is neither the projection of human perspectives over the microbial field as examined by sciences nor the mediator of the movement of abolishing humanness, nor is it an extensor of prosthetic life as the post/transhumanist approaches would assume. The engagement is an in-betweenness of human and microbe, which situationally sweeps them together towards a becoming-other within the stirring of tensional forces

traversing both. It performs the “in-between” by its distancing with respect to the existential parameters of these two terms and according to its capacity of exceeding them.

In this respect, microbe-artworks are not simply mediator or populariser of scientific discourses. On the contrary, they crystallize the artfulness that expresses a relational field’s complexity, and that actually condition scientific formations in multiple ways (as a matter of degree of consistency in regards to this aspect of artfulness). The fact that our relationship with microbes assumes the mediation of a scientific field of activity does not change the fact that its priority was established only retrospectively. In contrast, retrospectivity is the index of a pre-discursive field’s existence. As we have seen in the 1st Chapter, this indexicality shows itself in the bifurcations of scientific statements. This means that only a pre-vital field potentializes the vital processes as examined in biology (Simondon, 1964). Whereas these potentials are dispersed in various fields of activity, they are consumed in certain ways to be reborn.

Artistic engagement seriates potentials by keeping them open without being exhausted as much as possible, while giving them a consistency without privileging the terms or tools that give rise to them, as the pure singular-genericness of microbiality. Microbe-art appears as the consolidation techniques of expanding the minimum difference, a difference given through the outcomes of being-microbe’s general parameters; useless but necessary. Ambulations that *tra-la-la* the refrains in microbiome studies (*making a microbe a verb*), revealing the multiple modes of symbiotic relationships. *Tra-la-la* starts with an echo and grows by reflecting here and there.

Echoing Microbe-Sounds

Microbe-sounds do not only present the consolidated echo modes arising from microbial sound production processes but also crystallize the relations of echo that cut across different fields of activity: basically, science, art, and philosophy. Therefore, they show the necessity of the concept of echo. The serial becoming of echoes exposes how science, art, and philosophy sink into a relational field, which precedes the frameworks of their field of activity to (re)invent themselves through (new) potentials. The literal meaning of echo—the reflection of a sound source, is also the propagation of sound after it hits various objects. In this sense, echoes are not one but many. This many-ness, however, once again consolidates itself, depending on factors emerging within the movement of the echoes doubling themselves. Echoes enter into a collective rhythm in a particular way, depending on the resonance between the elements, their intensity, and accordingly, their

coming together. In this sense, an echo is both emergent and persevering. As we have seen before with Tarde, patterns of interference and resonance are appropriated in effect without requiring a prior subject thus enabling relative transfer of these patterns to subsequent returns. In Simondon, this is the expression of the coming-together of disparate elements enveloped in tension as to be resolved through transductions.

As Mickey Vallee shows in his article “The Rhythm of Echoes and Echoes of Violence” about Steve Reich’s 1966 tape-loop composition *Come Out*, sound is always-already resonance (2016)¹¹⁶. In *Come Out*, the resonances, interferences, vibrations, and turbulences are transduced into effects to be *heard* as echoes in terms of their actions and relations, referencing other echoes and bringing their unheard dimensions through their qualities as a complex of rhythms made of many speeds and tempos. That an echo is constituted by a multiplicity of echoes invests the gap between them by echoing them in repetition, a repetition that brings a difference in the non-resemblance of an analogy. The affinity between the refrain and echo comes from this:

The refrain also has a catalytic function: not only to increase the speed of the exchanges and reactions in that which surrounds, but also to assure indirect interactions between elements devoid of so-called natural affinity, and thereby to form organized masses (Deleuze & Guattari, 1987, p. 348)

In this sense, echoes assume a catalytic function by making possible indirect interactions. We are thrown into an uncanny world through and with them. But this process should be traversed and land in an outcome. The result will be more or less habitual or in habitual, familiar or unfamiliar, and ordinary or extraordinary. How will the tension be resolved? What will be the techniques that will spatialize the rhythmic temporality of “various vibrations, or decompositions, projections, or transformations” (p. 348). that crosses the tensional field? Catalysis settles at the heart of the context of the rhythm production of rhythms as the future’s openness by digging up an interval. Uncertainty, not as an anxiety of unanticipability but as an echo’s enthusiasm, triggers a process of transformation.

¹¹⁶ Vallee appeals to the deconstructionist accounts on the concept of echo to develop his analysis. See Nancy, J.-L. (2007). *Listening*. New York: Fordham University Press; and Lacoue-Labarthe P. (1998). *Typography: Mimesis, Philosophy, Politics*. Stanford, CA: Stanford University Press. For a sociology of haunting, see Gordon, A. (1997). *Ghostly Matters: Haunting and the Sociological Imagination*. Minneapolis: University of Minnesota Press.

In an artwork, microbe-sounds consolidate a refrain captured by sciences, making the echoes re-echo in other turns. Microbe-sounds relate to a particular rhythmic interlinking of accelerations and decelerations, increases and decreases, starts and stops, which form vital processes. They form a certain quality of movement captured by scientific or technical tools, then transduced to musical notes that are the minimum unit of nature's musicality in the human world. They are then recomposed according to the instruments in this sphere. Meeting at a minimum functions as the membrane where the disparate elements become sensitive to each other and grow within rhythmic articulations. A similar process might take place in research, thinking, or writing, this time each with their own processual resources. A process where a thousand of probe-heads engage in infinite modes of relationship, symbiosis or parasitism, catalysis or inhibition, propagation or curtailment, until arriving at a threshold of perceiving the impossibility of a newborn. A creation born out of those probing heads' consolidation at the limit of imperceptibility. A search for an impossible that does not seem impossible, an outcome-giving process that seems full of *clichés*. Then, burgeoning beyond a certain threshold. Research-creation as the making possible of an impossibility.

Chapter 6

What Do We Experience With Microbe-Milieux?

The human-microbe relationship has increasingly taken on complex dimensions. On the one side of this relationship, we have the specialization of sciences, on another—the specific cultural and social formations that shape scientific activity, and on yet another, the conceptual refinement of our thinking of microbes. All three affect each other and relay these effects to their respective planes in their respective ways. In order to understand this complex field of mutual interaction without having to reduce it to a single explanatory scheme, different philosophers have proposed the concept of milieu. The concept of milieu allows for the posing of problems with respect to the complexity of these fields. As our conception of microbes becomes less reducible to pathogenicity and distributed in the social sphere in various ways, so it becomes necessary to construct the coupling between milieux and problems in different ways. Different milieux are implicated within themselves and enter into various complex relationships between each other. This is the problem itself: a field arising from the ways in which the milieux fold together: a problematic field. We have already seen the priority of vision in scientific epistemology's constitution and the development of necessary apparatuses for this task (their inseparability), sound's implication in these apparatuses and its constitution as an autonomous field. Finally, in this chapter, we will see that how other senses like touch or smell as the ingredients of a milieu of microbial interactions would be integrated in the layers of knowledge and posited as a matter of artistic expression in microbe-artworks. All of these, however, find their meaning in the construction of a problematic field.

Microbe-artists learn from the sciences, and in their own ways, carry what they have learnt into an aesthetic composition. However, if we look at this process from the perspective of there being a reciprocity between microbially and the social field, this implies that the microbial field should already involve some aesthetic forms. At least in germ, these aesthetic microbial forms then might become part of the human experience through sensible forms. How do we conceive of these germinal aesthetic forms without falling into anthropocentrism's traps? How do they emerge as

part of scientific research, and in which ways do they persist in artistic enterprise? And finally, what is the expression of this persistence in the plane of thinking? A continuum where science, art, and the thinking of their coming-together come together with their differences is the most general problematic field of this chapter.

The Milieu of Symbioses with Microbes

Symbiosis refers to the interactions of animals (including humans) and plants with microorganisms throughout the animal kingdom. This idea disrupts the notion that the individuality of organisms is secured by firm boundaries. Hence, the individuality of animals cannot be considered solely in terms of anatomical or physiological criteria. A diversity of symbionts plays a role in metabolic pathways and other physiological functions (Douglas, 2010; Gilbert, Sapp, and Tauber, 2012) and the mechanisms which provide stability for the organism are in part created by microbial symbionts (Gilbert et al., 2012, p. 87). In vertebrates, for example, bacterial symbionts play a part in the specification and organization of the gut-associated lymphoid tissue. Without the presence of symbiotic microbes within the gut, the immune system and the organism's metabolism would not function properly and would not be capable of responding to changes in the environment (Tauber, 2012). The work of American biologist Lynn Margulis shows that humans are the products of longstanding alliances between bacteria, viruses, and human cells (Margulis, 1997). This means that humans and microbes evolve together and affect each other in different ways.

At the same time, the role played by microbes cannot be reduced to exchanges at organismic level. Some microbial organic compounds function as behavioral cues for the organism and become more and more sensitive to microbial metabolic elements that “advertise nutrient sources, competitors, predators, mates, and habitat suitability” (Davis et al., 2013, p. 841). What kind of events will trigger behavioral cues is basically determined by two main lines, according to the manner of a field of tension that is polarized by an orientation towards either competition or destruction. The microbial communication channels require some sense-modalities to navigate the metabolic functions in order for an organism to be oriented towards food or escape from danger. As Hannah Landecker and Christopher Kelty have demonstrated through the effect of rancid butter's odor, at metabolic level “microbial metabolite is more than a cue or a signal or a smell,

more than an energy source: it is a participant” (Landecker & Kelty, 2019). A small percentage of short chain fatty acids mixes to the bloodstream (Besten et al., 2013) and “plays a role that is ‘more regulatory than provisioning’” (Landecker & Kelty, 2019).

Landecker (2019) grasps this microbial involvement, which takes place at metabolic level, through Canguilhem’s concept of milieu and the organism’s complex modes of interaction with its environment. In Simondon, these modes are explained by the constitution of problematic fields, which also include the perspective of human beings, but essentially extend beyond it (Simondon, 2013). Simondon’s research object is not human or animal in general, but specific living beings such as viruses, bacteria, algae, jellyfish, crabs, bees, and ants and the modes of relationality between them and their environment. The effort of thinking of an animal and its vitality from a perspective that is not sealed to humanness is to think about the apprehension of forces that enliven the relationships between different living beings. For this, it is necessary to both consider a particular mode of relationship and to determine the modes of relationships, and in this way, make thinking itself relational.

For Simondon, living means the becoming-together of three dimensions: action, milieu and being part of an individuation (p. 213). The process of individuation, which consists of a series of operations, determines how these three dimensions come together and how the relationships between them are to be interweaved. Milieu and individual are a couple, which indicates that neither of them is given and that they emerge together as a result of a process of individuation. This means that the individual is an end product and that its emergence involves an eventual dimension. This eventual dimension implicates the problems encountered in various perceptive, active, or adaptative conduits of living beings and in the partial solutions produced as a response. Muriel Combes (2013) explains this dimension through the confrontation of living beings with a series of problems:

[I]l faut se souvenir qu’un vivant ne cesse d’être confronté, tant qu’il vit, à une série de problèmes : percevoir, se nourrir, éprouver une émotion apparaissent ainsi comme autant de tentatives pour résoudre tel ou tel problème de compatibilité avec un milieu. (p. 30)

A tension arises between the elements which is brought up by the anterior resolutions that partially sustain themselves in the successive resolutions according to the ways in which the milieux restructure themselves. This tension consolidates itself as an adaptative act, but also always as

more than that, as something that cannot be answered by remaining within the confines of previous solutions. At some point, a solution needs to be improvised and all milieux are to be re-coordinated accordingly. Living, for Simondon, is a process, without an *a priori* vital psychic force impelling from behind, where the partial solutions integrated into the rules complexify the problematic fields and give rise to the emergence of new solutions. This process constantly triggers the invention of new forms:

Par là, on pourrait rendre compte du fait que la vie dans son ensemble apparaît comme une construction progressive de formes de plus en plus élaborées, c'est-à-dire capables de contenir des problèmes de plus en plus hauts. L'axiomatique vitale se complique et s'enrichit à travers l'évolution ; l'évolution n'est pas à proprement parler un perfectionnement mais une intégration, le maintien d'une métastabilité qui repose de plus en plus sur elle-même, accumulant des potentiels, assemblant structures et fonctions. (Simondon, 2013, p. 213)

Simondon calls this process of differentiation-integration, which is constantly complicated by the implication of new problematic elements, a vital axiomatic. Vital axiomatic implicates two complementary aspects of the resolution. These are terms at the two extremes, plus the reality of their meeting at a middle. The individual and milieu are two phases of being. They are the end points of a doubling that comes into play as an inventive resolution that assumes a preparatory tension and an incompatibility they transform into asymmetric restructuring. This means that being appears in the phase-shifts between individual and milieu, falling out of step with itself (*déphaser*) at one moment so as to condition new individuations¹¹⁷. Being is re-coordinated by leaps and amplifications, according to the partiality or totality of dissolutions depending on the degrees into which they correspond and their rhythmicity as the destructuring and restructuring of the system

¹¹⁷ Simondon, with reference to Vladimir Jankelevitch, determines the thanatological (concerning death) dimension of the problematic (Simondon, 2013: 271). An individual is located both on the problematic side and on its solutions. It both presents some elements to be apprehended as part of a problematic field and goes beyond these presented elements by re-coordinating itself with respect to the proposed solution as a necessity of its ongoing self-propulsion. Death is a moment where human beings realize that they are finite beings, through which they find themselves in problematic situations. Therefore, this fact of being finite poses itself as a problem. For other living beings, the same problem is somehow postponed through the mutual referring of individuals of the same species with each other. For example, the death of an individual in a colony takes nothing from the colony itself. For Simondon, this indicates that the colony itself has a mortal character and real individuality is embedded in the colony (pp. 166-168).

(Simondon, 2013, p. 315).

Being is relational or “the individual is being *of* the relation” (p. 63). The individual does not relate to itself or other realities (this would be to reduce relation to its terms). It is not “in relation”; it is the being of relation; it is traversed by relationships and constituted through them. The individual is not the subject and the world the object. The individual is a mode of existence that bifurcates in regards to the heart of the event (resolves tensions), deepens itself while aligning, adapting itself (expands its axiomatic), and is not independent of the milieu into which it is integrated. It is affected by the milieux that it can affect in return; it produces qualitative, affective polarities: primarily attraction/repulsion, then pleasure/pain, joy/sadness, happiness/ unhappiness, exciting/depressing, etc., depending on the degrees of complexity of the living being (p. 252). These are not humanly defined emotions, but the preliminary distributions of the immanent dimensions of an encounter with an environment in a milieu-individual coupling. It is here that the problematic field arises where the question of what kind of resonations would take place among individuations and how the instant of encounter’s shock would be related to other instants with corresponding polarisations and orientations will be posed according to the structuration of the sub-problematic fields.

As we will see next, artist Saša Spačal turns the microbe-human symbiosis problematic into artwork. In this way, the work itself becomes a problematic field that contains many other problems.

The Art of Human-Microbe Symbiosis: The Work of Saša Spačal

In her installations, Spačal makes the microbial relationships with the environment that are complex but not directly perceivable by human beings feelable. This is realized by a gesture that makes the installation itself a milieu among other milieux. For example, in *Mycophone_unison*, an apparatus activated by human touch which produces sound brings an impression related to the microbial world to perceptible level¹¹⁸. The unit where this transformation takes place is coded as the central celestial plate symbolizing the feedback processes between human and non-human

¹¹⁸ https://www.agapea.si/en/projects/mycophone_unison. Accessed 15 July, 2020.

elements. The presence of microbes in the installation, however, is not only symbolic. Microbes such as bacteria, fungi, and archaea, which form ecological communities within the human body, interact with each other and with other processes in the human body. In *Mycophone_unison*, the sounding device is inhabited by microbes sampled from human bodies. The fingerprint of the visitor sends a signal processed through the central celestial plate to the microbes in the petri dish that modulate the response. Samples taken from the human body and grown in the biological laboratory, and their implication in the mechanism of installation, summarize the complex microbial relationships in a unit that shows the limits of the classification of microbes as species.

In *Mycophone_unison*, Spačal makes this complexity felt by sound, albeit for a moment. What we hear thanks to this sound is the ecosystemic relationships human perception is normally unable to perceive. Thus, in the process, we come to understand that human beings are both producer and a part of these relationships. In *Mycophone_unison*, microbial and ecosystemic complexity is summarized in sound. Microbial samples and human participant share the same habitat through the installation's signalling mapping. Thus, the work itself becomes a question pertaining to what happens in the microbe-human continuum in which some microbial relationships become representable at the level of perception or which aspects of the human world find their direct counterpart in the microbial world. In terms of *Mycophone_unison*'s operability, it is provided by the modulations between human/microbe interactions through the sense of touch and sound. What is animated by the senses, however, is not exactly something related to microbes. In the following sections, we will see other examples of microbe-artworks where the senses are directly involved in this process. But first, the question of how relationality in a symbiotic relationship is established deserves to be dwelt upon.

One of the main characteristics observed in microbe-artworks is a certain effort to approach to the microbial field to escape the dangers and traps of anthropomorphism. Simondon's philosophy also explores the philosophical expressions of this kind of approach. He provides a framework that posits human beings and other creatures in the same continuum. Simondon accomplished this through his insistence on grasping the individual through physical, biological, psychic, and social processes before it emerges as a full-fledged entity and thinking of the transitions between these fields without reducing one to another.

On the Tracks of Gilbert Simondon's Crab and Anemone

Simondon, known for his theory of individuation, spreads the problem of living into modes of existence between living beings. His philosophy takes precautions against both *hylemorphism*, where a given form imposes its structure over an ineffective matter, and substantialism or essentialism, where *causa sui* being reproduces individuals, while itself remains unchanged¹¹⁹. Initially, the transition from the realm of physics to the realm of living beings provides a plurality of examples to explain vital individuation. This transition can be characterized in the conditions for the conversion of non-organic matter into organic matter, then, the organization of certain living forms (e.g. single-celled, sponges, multicellular, worms, etc.) and the relationships that different species establish between each other (parasitism, commensalism, symbiosis, etc.). Simondon takes this framework to its limits where problems specific to the living world remains insoluble and thus condition a transition to the social world. This expresses at the same time the emergence of the collective and correspondingly the individuation of thought, which envelops all individuations by its own means and with its own problems.

By addressing the symbiotic relationship between the hermit crab and anemone, Simondone explains the different causal regimes between living beings. This way of approaching the problem of symbiosis offers an opportunity to think of life in a relational manner as well as to problematize the thinking of this thinking. According to Simondon, the mode of symbiotic relationship is based on a different logic than the logic of parasitism. In parasitism, one of the parties becomes dependent on the other, while the other becomes dependent on this dependence itself and they orient together towards a destructive future. Contrary to parasitism, in a symbiotic relationship, the parties continue to remain separate entities and the causality regime of inter-individual relations is very different from each other (Simondon, 2013, pp. 195-200). Both the

¹¹⁹ Simondon's philosophy is often read as a critique of hylemorphism. There are many passages in Simondon's work that would make such a reading correct. In fact, Simondon exaggerates the criticism of hylemorphism so much that he states that it is now so deeply rooted in culture that it has come to impose itself as the only viable philosophical construction (Simondon, 2013: 309). On the other hand, Simondon states that the basis of Aristotle's system, whom he regards as the initiator of hylemorphic understanding, contains an ontogenetic element, even if it remains implicit (543). For an approach that reads Simondon not as a critique of Aristotle but as an advancement of his philosophy, see Margairaz, S., Rabachou, J. (2012). *De la génération à l'ontogenèse: le préindividuel et la puissance chez Simondon et Aristote*. Cahiers Simondon, 4, 69-97

crab and anemone put in place the existing schemes of relationality that evolution has brought to them and rebuild their systems according to their encounter with each other. This shows that adaptive actions are not simply a conformal patterning to a given environment but rather that every action is a process of invention depending on the crystallisation of the milieu and the capacity to modulate the environmental elements.

The crab that Simondon mentions lives in a shell. As it grows, it does not fit in its shell and searches for a larger shell suitable for its new size. When it finds it, it leaves its shell and enters the new one. The shell provides hiding and protection. The crab also uses the shell to attract its prey. It grasps the colored objects it finds on the ground thanks to its pincers and puts them on the shell; it then hunts for creatures that are attracted to these colors. When the crab meets an anemone, instead of a colored object, this time, it puts the anemone on its shell. This *decision* results in a more positive outcome than the crab expects. The anemone attracts prey much more efficiently than colored objects; moreover, it paralyzes them thanks to its sticky feet. Therefore, the crab begins to hunt much more easily. The anemone also benefits from this relationship. The crab's mobility carries the anemone to places where food is more abundant, and besides, the crab's shell provides more protection. Even when the crab can no longer fit in its shell and is prepared to settle in another one, it does not give up this relationship developed with the anemone. It exits from the old shell, enters the new one, then turns around and grasps the anemone with its pincers and places it on the new shell. For Simondon (2013), the crab, anemone, seawater, and shell form a complete community (*société*) (p. 199). While each of these components has different levels of individuality, they organize their environments together and exchange information.

Although mutual benefit is obvious, Simondon does not see this relationship as an example of utilitarianism and avoids substantiating the symbiotic relationship. The main question for him is not whether the anemone and crab use each other in a mutually beneficial way but how some tendencies traversing the crab and anemone come together as to orient together. This entanglement of tendencies will also fluctuate existing structures and functions and restructure them based on new tendencies and patterns of actions. This relationship, which is neither foundational (originating from a foundation) nor teleological (moving towards a determined aim) gradually finds its echo in an effort of thinking throughout a trajectory of modification of the crab's and

anemone's modes of relationships, with the modulation of internal and external milieu, at the conjuncture of the eventfulness of the associated milieu.

In the next section, we look at two examples of microbe-artworks through these modes of interaction in symbiotic relationship with microbes with respect to corresponding scientific explanatory schemes. This trajectory will also lead to a problem of the individuation of thought in terms of microbes as interfaced by microbe-artworks.

Economy of Symbiosis

In *Symbiome – Economy of Symbiosis*, in collaboration with Mirjan Švigelj, Spačal creates an installation that consists of elements such as the red clover plant (*Trifolium pratense*), bacteria of the rhizobia species, and water, where light is transformed into sound and the system is able to sustain itself as a small ecosystem¹²⁰. In her approach, neither is the environment an absolute unity organized by functioning sub-units nor the relationships of living beings with their surroundings consist of the given blocks of relations. In *Symbiome*, two biological species nurture a symbiotic relationship and the degree of intensity of their relationship is measured by the ripples on the water surface. The ripples on the water surface are detected by a light sensor that translates them to sound. The sound is generated in real-time and filtered through phase modulation. Visitors also participate in this installation via their exhalation of carbon dioxide and, accordingly, become another element in the modulation of the system. The symbiosis points out to a mutual benefit but essentially indicates that each loop in the ecosystemic operator is a process of amplification. This is where the *Economy of Symbiosis* part of the title comes: the system is economically able to sustain itself through the mutual benefit of the rhizobia and clover and participation of other elements from their own angle so as to create some extra-effects¹²¹. Spačal also understands this economy as a metaphor for the economic relationship between natives and migrants who may benefit from each other by reference to the use of the same elements.

¹²⁰ <https://www.clotmag.com/biomedica/sasa-spacal>. Accessed 15 July, 2020.

¹²¹ For a comparison with the notion of economy in regards to the problem of image, see, Deneault, A. (2019b). *L'économie de la nature*. Montréal, QC: Lux Éditeur.

Experiencing Microbe-Milieux in Sonja Bäumel's Work

The work of Sonja Bäumel's can be said to also operate as a sort of "economy" in its own way. Bäumel translates the material qualities of the microbe-human continuum into perceptible aspects for humans. In this regard, rather than focusing on ecosystemic features, Bäumel directs the focus to some microbial qualities' equivalent expressions for human senses such as touch or smell, and the characteristics of the environment in which these sensations are experienced. One aspect of her work challenges the human-centered perspective of the fashion industry and another refers to the microbes' complex communication methods such as quorum sensing. In *Crochet Membrane*, clothing texture changes according to the bacterial populations' responses to changes in temperature¹²². Slime fungi coat clothing as a visible, flexible membrane that can interact with existing skin bacteria and adapt to its climactic surroundings. Since the fungi can coat everybody differently and thus become an expression of each individual's microbiome¹²³. In a sense, *Crochet Membrane* is a sort of cartography of the human body, as Bäumel puts it. Materials that are used as a reflection of social hierarchy or certain historically inherited forms are now replaced by various modes of sensation, which vary with the dynamic nature of the environment. This emphasizes the membranous structure of sensation. In the work, bacterial populations create a separate skin layer of fabric and this layer is designed to interact with other layers. Sensation is the place where all of them dissolve and make the change visible since sensation refers to the conjuncture where a critical point is reached at the intersection of individual and milieu, habitual and inhabitual, containable and uncontainable. The clothing makes the intermediariness of the sensation visible and perceptible in terms of the conditions of the human body. It transmutes into different forms, colors, and functions related to environmental changes.

This, in fact, indicates that microbes have a number of mechanisms that show their sensitivity to this change. Although these are not directly sensual forms such as touch or smell like in the human body, they germinally carry sense-like features and mechanisms. *Crochet Membrane* manifest this in the textile through microbes' sensitivity to temperature. In Bäumel's *Fifty Percent Human* or *Being Encounter*, for example, human visitors might experience in the artworks' milieu the sensory aspects that arise from specific microbial channels of communication. Before looking

¹²² <http://www.sonjabaeumel.at/work/bacteria/chrocheted-membrane>. Accessed 15 July, 2020.

¹²³ <https://www.asbmb.org/asbmb-today/people/040116/clothed-in-bacteria>. Accessed 15 July, 2020.

at how Bäumel realizes this, let us briefly examine how the forms of microbial communication are established in order to understand how they are implicated in microbe-artworks.

Microbial Communication: Sense and Viscera

Microbes have no sensory organs in the classical sense, but they can still perceive their environment. A sensation's surface effects are processed by the senses that are traditionally conceived to be at the surface of the body—"smell in the nasal epithelium, taste in the tongue, sight in the eye, touch in the skin, where digestion, nutrition" (Landecker, 2019, pp. 55-56). The viscera, however, are related to the deeper mechanism of the body through which metabolic functions are realized (Landecker, 2019). Landecker's emphasis on the metabolic level of visceral and sensible functions relativizes the duality between inside and outside by referring to the visceral in the sensory mechanisms and to the sensible in the visceral mechanisms. She focuses attention to their coming together in biological events in membrane-like structures in biological systems where the visceral and the sensible are mutually included. We can give two examples of this, the sense of smell and touch.

Odor plays an essential role in the symbiotic relationship between mammals and microbes (Carthey, Gillings, and Blumstein, 2018, p. 887; Albone and Shirley, 1984). As Landecker points out, the butyric acid produced by microbes has a function in mammalian signaling. It does not only travel in the body with its odor-like pattern but roams in the body by functioning as a substrate for the modulation of gene expression and intercellular signaling (Landecker, 2019, p. 56). This indicates that, between senses and viscera, odor participates in producing the very texture of the interface of '-intra and infra-cellular activities' membranous structure. Olfactory mechanisms traverse both senses and viscera through a network of highly specific interactions between bacterial cells, their metabolites, and human cells and tissues, underwriting the signaling mechanisms both at organismic and sub-organismic levels. When the large diversity of G-protein couple receptors associated to smell and sight arrive at the nasal epithelium, they already bring the possibility of perceiving thousands of smells with different odorant ligands, which will be transduced into a particular sense experience of the smell . This means that every sense experience is a process of incorporation in which thousands of differentiated molecular perceptions of smell are integrated in the uniqueness of an experience. It

also indicates that there is a sort of action at a distance between microbes and humanly organismic features thanks to the sensing-mechanism not directly related to the nasal sensory apparatus. As Landecker puts it more beautifully: “the body acts on itself, across its own distances” (p. 57).

The second example, that of the sense of touch, shares a similarity with the sense of smell example in terms of microbes’ capacity of temporalizing their responses to spatial gradients. Temporal gradients such as chemotaxis trigger a cascade of events determinant in the birth of the sense of smell¹²⁴. A microbe senses a change in the concentration of a chemical outside the cell over time and responds by actively swimming toward or away from the chemical (Hug et al., 2017). Microbes that live on the surface of a solid substrate such as a biofilm recognize surfaces and respond to this mechanical stimulus within seconds (Hurtley, 2017). They are capable of reading out mechanical stimuli and changing their behavior in response to these cues. The cells attached to the surface recognize their substrate interface and localize adhesins toward that region. This mechanism helps the cells to induce the production of their own instant adhesive. The process maps a cell’s biochemical sensory response by the actual binding activity of specific proteins. This shows that microbes have a sort of primitive sense of touch.

For example, bacteria with flagellum such as *Caulobacter* or bacteria such as *S. aureus* that grow as a biofilm on surfaces such as skin or the mucous membrane of anterior nares have a kind of mechano-sensing mechanism. Since massive groupings of bacterial population reflect the stratification of these touch mechanisms in a biofilm, a new problematic area opens both the possibilities of bacterial communication’s investigation of complex structures and their interpretability to human touch. With which material processes, under which visual or olfactory conditions can the microbial enigma be made noticeable? Some of Bäumel’s work operates on this problematic field.

¹²⁴ Chemotaxis basically means the movement of an organism in response to chemical stimulus. In the context of microbiology, chemotaxis refers to the migration of cells toward attractant chemicals or away from repellents. It is generally induced by a specific substance. This substance can be a chemokine, a chemokine receptor, a growth factor, or a growth factor receptor. In this way, different elements establish a chemotactic tactic network that plays an important role in health and disease.

Being Encounter

In the last scene of Lars von Trier's film *Melancholia* (2011), the main character—Justine (Kirsten Dunst) takes her older sister and nephew to wait for the end of the world under a patchy structure made of wood. This is the only thing that can be done before a global disaster: to collect whatever is left of humanity and spend your last moments under a fragile structure that might, at least a little bit, soothe some of the anxiety of the impending death and a world shuttering. It is Justine who first feels the coming disaster before it emerges thanks to her sharp sensibilities and who confronts it in advance. It is this intuition which brings Justine to the preliminary insights of what would happen in a disaster by making daily life a kind of disaster. Thanks to this preparatory role of intuition, Justine more powerfully than anyone else, floats through the disaster and finds the strength to survive until the last moment. However, that is everything intuition can offer in this particular narrative, a palliative solution. The feeling of anxiety, the main dimension of the disaster's eventfulness, predominates in the environment. The only viable option for anyone, really, is to hold onto a small piece of serenity that an ephemerally built house provides.

In Bäumel's *Being Encounter*, intuition plays a preparatory role, not for disaster but playfulness. In the installation, visitors are invited to go under a patchy structure but this time to play with microbes. What they experience is not the destructive side of microbes that could easily refer to a sense of disaster but the expression of various forms of microbial communication in the human senses. A dome-style structure is suspended from the ceiling with ropes, inviting visitors to enter and leave themselves open to the possible effects of microbes. This is a milieu in itself: to touch, smell, and feel the alienness of the microbes that cannot be encompassed by human speciesism. If you raise your head and look at the mirror in the concave shape of the dome, you see a deformed version of *reality*, which serves a moment of self-recognition for human beings: you experience nothing but an extra-effect of a milieu of milieux.

Impressions about microbes never exactly correspond to the ways they are represented in human consciousness. The feelings you get from touching and smelling the pouches where the microbial populations are gathered are the results of transductions. Operated up by the pathways of visceral communication, they cross the human-microbe continuum into the level of human perception. Bundles of germinal minor perceptions are again transduced into human consciousness and are re-expressed according to the dimensions of plane of thought own processual resources.

Just as the senses of touch or smell create an in-between layer on which surfaces such as skin or the nasal epithelium combine with other layers depending on environmental elements¹²⁵, so some aspects of experience resist complete positioning in human consciousness as a kind of enigma. This shows that human perception is surrounded by thousands of olfactory and tactile perceptions transduced to a level of representability as incomprehensible perceptions or not-yet-thoughts. The expansion of human and microbial entanglements' multiplicity into imperceptible elements of sensible experience in *Being Encounter* posits the composition of the installation as a problematic field.

It is not only that complex modes of microbe-human symbiotic relationships are transformed into a sensible experience in *Being Encounter* but that they also appear as a problem for thinking. The problematic field that appears through the microbe-milieu also induces the individuation of thinking. To understand how thinking itself relates to the field of biology, it is once again useful to return to Simondon's philosophy of individuation. Simondon's elaborations on the emergence of thinking also concerns the emergence of the project at hand, an attempt of individuating a thinking with and through microbe-artworks as an echological project.

Individuation of Thinking

To address the problem of the individuation of thought, we can return to Simondon's example of the symbiotic relationship between crabs and anemones. There are links between what is happening to the crab, the anemone, between crabs and anemones, between crabs, anemones, and scientists who study this relationship, and between these scientists and the philosopher who wants to consider this relationship in a philosophical way (and so on). These links can be held together in their autonomy without assuming a chronological or hierarchical relationship, that is, by implicating their own complexity in themselves. Crabs and anemones meet in the crystallization of many factors and conditions. They mutually reconfigure themselves to be in a higher-level mode of relationship. The signal coming from another field (zoology) to philosophy shows that the philosophy is not external or indifferent to the field where the signal comes from. Instead, it shows

¹²⁵<https://www.unbore.org/stories/2019/10/24/microbiome-or-how-to-have-a-relationship-with-our-microbial-half>. Accessed 16 July, 2020.

that either it has not yet reached philosophy or is not yet adequately comprehended. When the signal reaches a certain intensity, just as in the crab-anemone relationship, a number of functioning mechanisms overlap. An encounter, a problem: how should we think of the relationship mode of the crab-anemone symbiosis?

Thinking of the Crab-Anemone Symbiosis

For Simondon, the reason for seeking to answer how we are to think of the crab-anemone symbiosis relationship mode is not to develop a framework that explains all possible modes of relationship or assimilate all the necessary steps for the constitution of thought. What matters for Simondon is not the conditions of possibility of the symbiotic relationship, but the reflective expression of how this relationship is established in the experience itself; the operational concepts that enable us to grasp this relationship without reducing it to its terms. Of course, the emergence of the crab-anemone relationship and the scheme projecting this relationship into a plane of thought do not occur at the same levels and refer to different types of event. Just as crabs and anemones come to a point where they encounter each other by passing through different processes and intervening mechanisms, so too philosophy passes through various preferences (or necessities). This makes the crab-anemone relationship a problematic in its own right¹²⁶. To the same extent as the crab and anemone go through a process of reciprocal evaluation, philosophy attributes a value to this relationship and makes it a component of its act of thinking. When Simondon encounters the crab-anemone relationship, he sees an occasion to advance the problematic field of his philosophy. The heritage Simondon inherits from zoology and philosophy also carries something from the effect-emotion complex propagated by the crab-anemone relationship (bringing signals from there). Simondon is influenced by the affective relational modes carried by the domains in which the effort of thinking pushes itself through the refinement of the set of relationships that will give rise to different modes of existence:

Chaque pensée, chaque découverte conceptuelle, chaque surgissement affectif est une reprise de l'individuation première; elle se développe comme une reprise de ce schème de

¹²⁶ See also Simondon, G. (2016). *Sur la philosophie (1950-1980)*. Presses universitaires de France, p. 25.

l'individuation première, dont elle est une renaissance éloignée, partielle, mais fidèle (2017, p. 257).

Between the individuations there is both continuity (*reprise*) and discontinuity each time a new element is added to the scheme (distant, partial). Individuation of thinking is as faithful as possible to previous individuation but never entirely. It is as far and partial as possible but never completely disconnected and disengaged. Depending on the situation, there are sudden leaps between levels and orders, and accordingly, a “transduction” between fields take place¹²⁷.

Simondon’s philosophical system is elaborated against the determinist philosophies that imprison reality in closed systems, a philosophy that takes the risk of entering the regions of contingency, change, and event. Such a philosophy derives relationships from event dimensions and assumes that converging sets of relations in these dimensions are metamorphosed within the event, within their singular coming-together. This indicates that there is no last stop to be reached. In other words, to posit a starting point and set an unchanging destination leads to wrong problems. To do this would annihilate the problematic nature of thinking. If being is relationality, that is—the relationship is not its terms but between them, then the system itself must be relational, that is—it must pose itself as the problem.

Given this, thinking then also problematizes its own milieu along with many others. Individuation of thought begins with this act of problematizing. Microbe-artworks are opened to biology in connection with microbes through certain discourses and laboratory practices. They also concern the conditions of knowledge production, biomedial and biopolitical processes, specific conditions of the art gallery or the museum, problems pertaining to the field of economy, or various ethical problems in general. Each of these fields participate in the artwork as a milieu. It is the interweaving of relations between milieux that forms the dimensions of the work. The problematization of microbe-artworks, which leads to individuation of thought, involves both a certain kind of involvement in these milieux and the conceptual expression of participation.

In this thesis, workshops offered a way of entry into this complex field of relationships. Workshops are occasions to both interact with the artists working in this field and to get an idea of the production process of the works, albeit partially.

¹²⁷ For the sudden leaps, see Simondon, 2013, pp. 99-101; p. 158; for the transduction by means of affectivity, see: p.160.

Workshops

If you are not a scientist or artist, your relationship with the field of biological arts that microbe-art can be seen as a part of passes through academic literature in this field or ethnographic visits to biological laboratories where artists work on their projects. In doctoral programs, especially in North America where they've taken on a client-centred flavour, the principle of "a little of everything to satisfy everybody" is not a suitable ground for entering and deepening the very multi- or even transdisciplinary field of biological arts. A kind of data fetishism has also started to become a part of this client-centred ethos. In this ethos, the relationship a student can establish with philosophical sources can be labeled as a form of textualism in an almost substantiated manner. This relationship is usually condemned to personal intellectual interest, unless the texts are not directly operationalized as a theoretical or methodological approach in the privileged locus of an encounter with the "object" of the study that is called a "field".

Meanwhile, if we are talking about Canada, it is a great advantage to have space where researchers can have very different interests and carry out very different projects. This in turn feeds a sort of collaborative ethos and students can work as part of a project in line with their own interests. All these points provide an advantage for being in close contact with hands-on approaches, which appears undoubtedly as one of the most important points for the biological arts. Many of the artists who work in this field have a close relationship with the academy and know the theories in the field well.

In all these respects, workshops organized at universities play a very important function in terms of joining the different aspects of biological arts with people who are not directly involved in this field or who have just entered. If one of the important factors that played a role in shaping this doctoral project was summer schools, another one was the workshops. Workshops do not only allow students to access the incredibly specialized areas of biology, but also to work with artists, hear first-hand about what is going on in the field, and also experience hands-on approaches by themselves.

The *Immortality* workshop organized in 2016 at Concordia University in collaboration with Marta de Menezes and Tagny Duff, the *Machine Learning For Artists* workshop organized by Gabriel Vigliensoni at Concordia University in 2017, the *Bioelectronics* workshop organized by Gilberto Esparza at Université du Québec à Montréal in 2017, and finally, the *Bacterial Biopigments* workshop organized by Whitefeather Hunter at Concordia University in 2018 all

played an important role in the development of this project and for conceptualizing the field I call microbe-art. As an example of the role workshops play and their influence on thinking of microbe-artworks and the question of milieu, I would like to dwell on the *Immortality* workshop offered by Menezes and Duff.

***Immortality* Workshop with Marta de Menezes and Tagny Duff**

This two-day workshop organized by Duff and Menezes at Concordia University had two purposes. The first was to discuss Menezes's interest as an artist in biology and her art practice in the field of biological arts. The second purpose was to not remain at the level of an intellectual discussion and aimed to provide the participants with insight into how a biological laboratory works. The main issue thus was to understand the artist's interest in the field of biology and what kinds of forms of expression this field offered her. In *Nature?* (1999-2000) and *Immortality for Two* (2014), Menezes tackled the possibilities of biology and biotechnology to provide new media for artistic expressions. As she puts it on her website:

I have been trying not only to portrait the recent advances of biological sciences, but to incorporate biological material as a way to convey an artistic discourse not possible with a different medium: DNA, proteins and cells offer an opportunity to explore novel ways of representation and communication¹²⁸.

On the first day of the workshop, Menezes explained why the recent developments in the life sciences excited her and how our ideas about humanity, nature, and living beings have changed with new findings in the functioning of biological systems. This excitement also included her first intuitions about a potential artistic production. However, if biological systems or biological entities themselves constitute a medium, then she would have to be as familiar with biological knowledge as possible and acclimate herself with its specific functioning mechanisms that might only be observed and exercised in a biological laboratory. This in turn gives rise to the need for the artist to pass through biological laboratory practices, a characteristic that we observe in almost all biological art projects.

¹²⁸<http://martademenezes.com/portfolio/my-work-explores-the-possibilities-modern-biology-offers-to-artists-thus-i-have-been-developing-the-use-of-biology-and-biotechnology-as-new-art-media-conducting-my-practice-in-research-laboratories/>. Accessed 17 July, 2020.

This aspect of the biological laboratory's implication in practices concerning somatic modifications can be found in Menezes' famous piece—*Nature?*, where one wing pattern of live butterflies was modified. De Menezes doesn't use artificial pigments or scars to create this effect but finds ways to induce the normal butterfly wing development with a new pattern, one designed by the artist. The result is both man-made to a certain extent and also contains natural features that can be described as non-human. In the words of Oron Catts and Ionat Zurr, *Nature?* is a “semi-living art”, “a part of complex living being sustained alive outside and independent from that being (Catts & Zurr, 2007, p. 231). The wing patterns of butterflies in nature arise as a result of complex evolutionary processes. Meanwhile, biotechnological means make their transform possible under “artificial” conditions. For this purpose, in 1998, Menezes started working in a laboratory with Professor Paul Brakefield at the University of Leiden. In the *Nature?* project, two main problems arose for Menezes: “How is the wing pattern formed during butterfly development, and what is the evolutionary significance of developmental variation around this process?” (Menezes in Kac, 2019, p. 218). After some time, Menezes finally found a way to modify the wing patterns by interfering with the normal development of the wing. Thanks to cauterising tools able to change wing patterns, the genes remain unchanged and the pattern is not transmitted to the offspring. When the butterflies die, the artwork dies with them.

Although the life sciences provide information on how a particular biological mechanism works, during the workshop, Menezes explained that this was not a linear process. Laboratory processes always contain a margin of unexpected results. Menezes assured us that it is sometimes necessary to change strategies and sometimes one might even face the impossibility of producing the aimed result. In a way, this also expressed the importance of the second day spent in the laboratory. Even though it consisted of following simple and predetermined protocols such as transferring already collected microbial samples into a new petri dish and feeding them in order to grow them, all the laboratory operations required specific attention and caring. It is here that the importance of the workshops is emphasised. The fact that biological systems, units, forms, and functions become a medium for the production of artistic expressions necessitates the acquisition of an ethnographic sensibility beyond a textual engagement with the birth, spread, and complication of biological discursive formations, and accordingly, a hands-on approach with the biological.

In his book *Alien Agency: Experimental Encounters with Art* (2015), Chris Salter examines how the different biological art dimensions come together in the context of ethnographic research, taking into account the reflexivity of his own framework. The basic question, according to Salter, is “how to turn difficult bioengineering research into an aesthetic experience” (p. 90). A field such as biological arts consisting of coming together of heterogeneous assemblages, as Robert E. Mitchell has emphasized, does not necessarily have a critical or “disinterested” distance from biotechnology, since it has “close ties with research institutions and [is] enmeshed in these systems” (2010, p. 60). Furthermore, the interactions between these systems create a “a field of knowledge” (Salter, 2015, p. 93), while they are not only articulated into the sciences’ regimes of production of functions but also use “a complex regimen of instruments, technologies, and methods” (p. 93). As Duff points out, we can also add to this dimension the governance of living beings as an indispensable aspect of laboratory practices at the intersection of art and science. “The artist, just like the scientists, must obtain approval from nationally regulated university health and environmental safety committees before working with biomedica in the laboratory and in some cases the art gallery” (Duff, 2014, p. 113).

Thinking With Microbe-Artworks

Although the interest we can call philosophical or conceptual towards the biological arts does not necessarily find its conditions of possibility in a close engagement with the laboratory as in the case of the artists, as we have seen in Simondon’s analysis of crab-anemone relationship, thinking can individuate itself only with and through the clusters of relationships that traverse the particular region of relationality under consideration. Just as the symbiotic relationship between the crab and anemone concerns the emergence of an extra-effect, which cannot be placed “according to a presumed one-dimensional scheme” (Simondon, 2013, p. 253), so this reflection finds its singularity through the understanding of eventful dimensions that are apprehended by a specific scientific knowledge. Just as living beings possess the ability of enacting certain capacities within their vital individuation, thinking increases a being’s capacity as long as it fulfills the requirements of a reflective attitude. Every thought has power just like every relationship belongs to a specific mode of existence. Thinking empowers itself by finding access to the bundles of relationship apprehendable by appropriate conceptual elaboration.

It warrants repeating: relationships do not simply consist of the terms that crystallize them. To open up to a relationship means opening up to the movement of forces that go through this relationship, to the effect-emotion complex (which Simondon calls affectivity). Opening to different complex of relationship depends on how the transindividual movement that traverses the milieu-individual couple and drives them beyond it is immersed in the preindividual field as to consolidate and singularize the signals in the regimes of in-formation. In the plane of thought, this signal presents itself as an “interest”; an interesting aspect that provokes curiosity and research. If the crab-anemone relationship was not taken as sufficiently interesting¹²⁹, for example, it would not fall into the field of zoology, and therefore, a reflexive attitude for Simondon in terms of the symbiotic mode of relationship would not have been born. On the other hand, this reflexive attitude originates itself and takes shape in a milieu. Muriel Combes (2013), in her book *Simondon, Individu et collectivité* expresses this coupling of thinking with a milieu in terms of the gradual emergence of ideas with respect to historical conditions:

Comme tout être réel, comme tout fragment de réel qui s'individue, une pensée s'enracine dans un milieu, qui constitue sa dimension historique ; les pensées ne sont pas anhistoriques, étoiles dans le ciel des idées. Elles émergent d'un environnement théorique d'où elles tirent les germes de leur développement, étant entendu que tout ne fait pas germe pour une pensée et que toute pensée opère, dans le milieu théorique de l'époque où elle baigne, une sélection. À partir de cette inscription sélective dans l'époque, la pensée se structure, résout peu à peu ses problèmes et, ce faisant, s'auto-justifie. (Combes, 2013, p. 16)

Thinking about microbe-artworks is to think of microbes. It is to think of the formations of scientific knowledge, the practices that have become available with them, the graspable/ungraspable aspects of life, the governance of vital processes, the emergence of extra-effects (values), and the mechanisms of circulation sustaining them. And in all this, it is to think of how a specific artwork is singularly composed in this complex field of interrelations. Echology is designed to qualitatively measure the distance and transitivity among fields and their ways of

¹²⁹ Although there is no concept of interest in Simondon, concepts like intensity, regime of information, and crystallizing germ provides a similar understanding to the concept of interest in Whitehead. Whitehead's concepts of importance and interest help to understand the degrees of intensity and co-formation process. See Whitehead, A. N. (1968 [1938]). *Modes of Thought*. Firepress New York. For the concept of crystallizing germ, see Simondon, 2013, pp. 73-77. For the importance of the formation of the crystallizing germ in terms of vital processes, see p. 233.

culmination in effects (extra-effects irreducible to the causes associated with them). in Thierry Bardini's *Junkware* (2011), we can find an example of a thinking originating from a similarly described field of complexity in biology in conjunction with the possibility of experiencing microbe-milieux. Bardini presents an example of the expressions of biological knowledge and its cultural and political implications in the plane of thinking. The work of Bardini dares to think of our present condition that has almost impenetrably complex dimensions that are entangled with the complexes of forces and to make it somehow conceivable.

In *Junkware*, the term "junk" (Bardini repeatedly warns that it is not a concept) refers to several fields from biology to literature, from biological arts to capitalism. *Junkware* instantiates the individuation of thought through the biological and social, and their various modes of implication and entanglement within a milieu but by inventing its own milieu as implicitly drawing contours of an ethical problem. The conceptual consistency of "microbe-artworks" as an ecological problem has a great affinity with such an ethical problem that will be the focus of the last chapter. But for now, we need to first show how the conditions of *Junkware* make an ecological impact on the current project.

The Non-Reviewability of Thierry Bardini's *Junkware* or the Bardini Effect

Bardini's *Junkware* (2011) takes on a challenge with the ungraspable complexity of the epoch we live in and the postmodern sense of absurdity and anxiety that comes with it. That it is a challenge should not be necessarily considered as a manual for resistance. Rather, it should be considered as taking into account of various strands of different problematic fields that also reflect certain future projections as a consequence. On the other hand, the oneness of this field is a problem in itself. In this sense, the influence of Deleuze and Guattari's *A Thousand Plateaus* (1987) on Bardini's own unique methodology is not accidental. *Junkware* is a multi-layered and multi-dimensional project like *A Thousand Plateaus*. Therefore, it is not possible to surround it in the range of a single problem or theme. The resistance of the book to be framed by one-directional causal line can be translated into logical terms. What happens when neither the origin nor ultimate goal is determined at the very beginning but when they emerge in the process in multiple ways? In other words, what kind of causation is at work when teleology turns into teleonomy as a result of determinations in the specific fields? What kind of world is the one that oscillates between being

and becoming, being and non-being, sense and non-sense, univocity and equivocity, immanence and transcendence, but “without predetermined principles” and in the absence of the first and final cause, which traces a certain panorama of the world we live in?

It is precisely this concern of Bardini’s to not start with grounded principles but to produce them throughout the research process with respect to the situatedness of the fields of knowledge he deals with, which makes *Junkware* unreviewable through defined results. Despite presenting itself as an ambivalence (it is ambivalent indeed), this is not simply a postmodern playfulness that operates only in its own plane and cares only for conceptual juggling (but this does not stop Bardini from playing). *Junkware* has an intense relationship with the milieux that it traverses. We can even say that its condition of existence is the relatively given exteriority of a milieu and a certain effort for arriving at an outside. It performs this as an act of breathtaking diversity in the complexity of the milieux within the organization of the book, which authorizes me to metamodel the plane of immanence of *Junkware* despite all of its resistance to attempts at integration.

For this reason, I can say at the very beginning what I should say at the end: just like strange displacement and reversal of causes and effects, teleology and teleonomy, the fragmented totality of the book calls for the possibility of an ethics within this performative act. On the other hand, it is necessary to consider this horizon of work with two other dimensions. In the first dimension, Bardini follows the same line of promise in his previous book—*Bootstrapping* (2000): initiating a diagnostic, a description and a conjuration of our age, and in the second, his original writing style comes to the fore, as part of his way of processing the materials.

The scene designated to engage with the forces of our times involves everything that overflows and remains of the so-called human identifier at a capillary level: the non-coding part of DNA, the “junk DNA”. Appeal to junk DNA as the center of gravity of the book is not at all an implicit biological determinism which would be defined by a modeling of all possible reality through which the engine of all becoming is anchored in the biological laws. First and foremost, “junk” is already a sociology, since this non-coding part of DNA “essentially makes us junk” (Bardini, 2011, p. 11). Thus, the term junkware does not address just a single area; it refers to a plurality of forms, objects, fields, meanings, and cultures. Junk and recycling are two sides of the same coin and oddly coincide in the logic of “capitalism of the fourth kind” (Bardini 2011; Choukah 2010, pp. 53-54). Bardini, instead of framing his research in terms of the search for

solutions that could potentially solve all the problems inherent to this new modality of capitalism, proposes to identify its tensions, dead ends, and transformations. Junk is a term cut out for this very task. It is:

used to be useful, to serve a purpose, or it was meant to eventually serve a purpose. Its time is always in between, a bubble in the efficient, productive time we unfortunately enough got hooked on in the so-called developed world. Junk lives in a time stasis. Junk is a luxury for the well fed; it incarnates the sentimental scrap we choose to love tenderly in these parts of the world. It materializes the memories of consumption that we grew up idolizing. Junk, on the other hand, is a necessity for the starving, only source of hope and cause of further trouble, chance of recycling and presence of an everlasting lag. (Bardini, 2011, p. 9)

This status of “junk”, or more precisely, its residual-status that resists the impulse to ascribe any kind of univocal status to it, and the unconceptualizable aspect of the residue is a point of entry, for Bardini, for opening the powers of thought. But the paradoxical side of this founding gesture, that is, relating itself to an ungrounded ground as the niche of stirring of all sorts of forces, necessitates repeatedly asking, in each chapter, Deleuze’s question of “how “to have done with judgment” (1998) in an implicit way. In other words, in each chapter it is necessary to (re)invent the methodological principles according to the structure of the collected materials so as to compose them within the problematic field of junk. For mapping the Google searches Greimas’ method of semiotic classification, for the evaluation of biological knowledge and of interviews with scientists, the redesigning of the program of the sociology of knowledge with the contribution of the STS field, for reading contemporary cyberculture with the tissue culture and pop culture literature and particularly science fiction... For Bardini, the diagnosis itself has an equivocal structure. Methodological principles cannot be reduced to the all-seeing eye of a single falconry look, but with every peak one dives into the fields as to meet with the complexity of milieux, as the methodological enactments. This leads us to the problem of style.

The form and content of *Junkware* converge in an ongoing dialogue as method and style merge in the zone of indistinguishability of writing. From *Junkware*’s polymorphism and multidimensionality emerges a methodology that embodies the suspended significance of metaphor and the delayed teleology of causality. A recursive causality which advances by sudden leaps; a metaphorization of the type “catachresis” that lurks in to be opened up to other realities. It is a media approach that sees the *medium* in its intermediality, in its character of always being in-between, differentially distributed in and apprehended by modalities.

It is not without reason that Bardini talks about almost everything in his book. He mobilizes a massing technique by passing from the condensation points arising from the interrelations between the massed material elements, from dense points to ideas, from the ideas to the membrane-like surfaces where the relations of the relations penetrate each other. The style issues precisely at the point of the breakwater of these currents: a minimum exteriority and maximum movement, as the condition of a non-judgemental attitude. The writer deletes himself by writing; even in the places where we think that we feel him the most, even though we suspect that he might be juking us, as a result of the sensibility that the momentum of writing has habituated and prepared us to, there always remains an aftertaste of a seemingly finished and sealed chapter, and it is this aftertaste which provides the continuity of the writing with its discontinuities, and the participation of the reader in the adventure of the writer.

A new mode of the sense of taste; after microbial or human mode, its ingression in the plane of thought, in writing. The individuation of thought concerns at this point the consistency of the modulation of the senses as the modalities of the patches of intelligible investments. The intelligibilities that a writer destroys while weaving them are replaced by the rhythmic tasteful blocks. The writer deletes or masks himself by various techniques but always leaves behind a smile or shows its teeth. This is exactly what the Bardini effect is: the invention of the non-fetishistic use of data and the humor of a hawk surveying a multiplicity of milieux.

This approach of media says neither the last word nor presents a closed system which presupposes an omniscient approach. Bardini's effort to avoid any "dogmatic basis" does not only give rise to the invention of an original style, insinuated under the figure of "stand-up comedy" but also actualizes a mode of co-constitution of things, forms, figures, concepts, and voices, in a way of living together with others, human/non-human, living/non-living, organic/non-organic (*Junkware* projects a future without anticipating it).

Here is the invisible but tangible aspect of *Junkware*, which is non-integrable but felt from the very beginning: the possibility of an ethics beyond all sorts of moralities. The "junk" that signs the epoch, surveys the milieux by the interface of junkware, which is "this ordeal, turning the modern industrial and postindustrial excretions into a new sense of what being human can mean" (Bardini, 2011, p. 22). Each theme crystallized in *Junkware* overflows from meanings to doabilities that are not yet intelligibly designated but that make themselves felt through problems as "the

prisms over world”, and bootstraps similar trajectories so as to invent a difference. This is the meaning of ethics. It can never be a moral principle but rather a way of allowing the infiltration of the collective through the plurality of problems. It is itself an ethical gesture that cannot be reduced to a theoretical/intellectual design. Bardini’s hovering between equivocality and univocity reveals the ethical reality as the becoming of being. With Simondon’s words:

La réalité éthique est bien structurée en réseau, c’est-à-dire qu’il y a une résonance des actes les uns par rapport aux autres, non pas à travers leurs normes implicites ou explicites, mais directement dans le système qu’ils forment et qui est le devenir de l’être.
(Simondon, 2013, p. 323)

An ethical reality presents itself in the individuation of thought within milieux, in its rebirth after each of its annihilation, its still-sustenance in the belief that every gesture has a capacity to make a change. It starts with this “still” bodies still do what they can do, they still give us lure for feelings, we still expect a better future, not an anticipated or a hopefully waited future, but in-between of the junk, in its productive time that fuses the source of hopes with the further troubles in the consistency of everlasting lagging “‘strange characters and trivial objects’ ... cultish science-fiction authors and lonely terrorists, stylish architects and writers junkies, avant-garde bioartists and French philosophers, ... the targets of viral marketing, bad eating habits, spam of all kinds, addictions of all types” (p. 24).

For A Microbe-Ethics

Microbe, like junk, is also a signature. Its problems come with its milieux. Microbe-artworks are an interface of this signature. This interface with a membrane-like structure is weaved through an ecological logic as the catalyst for relationships and barometer of the distance through which the milieux are implicated. The tension between the preindividual, which concerns a field of potentials, and the impersonal zone forming the molecular tissue of collectivity and its way of finding resolution give birth to individuals, subjects, functions and forms as a result of the structuration of process. Processes reverberate and catalyze relationships.

Ethics is precisely this being of catalytic relation. It is weaved in an ec(h)ological way within milieux and through problematic fields. Microbe-milieux reveal that this sensibility is already implicated in the experiential sites through the senses. How this sensibility is (re)structured

according to its own operations concerns the problem of value as the main axis of the ethical problems, which requires specific examination through microbe-artworks that directly deal with this problem. This question will be the focus of the last chapter about a microbe-ethics.

Chapter 7

The Valuation of Microbes: For A Microbe-Ethics

In all the microbe-artworks analyzed thus far, an ethical aspect or sensibility was always at stake. In this chapter, I conclude by presenting the selected microbe-artworks as the emergence of an ethical problem in its own right. For this, I make use of the notion of value. In these works, microbes or “microbiability” assert themselves as entities that possess a value in themselves. Microbe-artworks engage with microbes from the perspective of being-microbe worthy of storing, exchanging, and moreover, self-proliferating their own value. What I refer to here as an ethical problem is not in reference to standards of value that already contain a certain semantic range and their projection over microbe-artworks. Rather, in this chapter, I consider the coming-together of the respective works’ assumptions and conditions of production as a problem in itself. I examine how these conditions come into contact with established norms to reproduce or deviate from them to ask: how do different sorts of values—scientific, economic, social or political, refer to each other, assume each other, and differ from each other under certain conditions?

The above questions already assume that ethics are based on a certain plasticity of values, their capacity for transformation with respect to the singularity of situations, in contradistinction to pre-set judgments of morality. For this reason, in order to build this tension between morality and ethics in the constitution of the selected microbe-artworks, I draw on Massumi’s elaboration on the concept of value. Value has recently become a major object of study but has been an important notion for Massumi early in his work. Massumi puts value at the very heart of ethics by answering Guattari’s call to rethink and reintroduce value to the ethical axis of existential territories (Massumi, 2017a; 2018). In this sense, Massumi’s thinking shares a lineage with philosophers Spinoza, Friedrich Nietzsche, Whitehead, Raymond Ruyer, Charles S. Peirce, and Deleuze for whom ethics refers to immanent analysis, analysis in action and of modes of existence, which are invoked and betokened by potentials and forms of relationality. This kind of analysis, however, is never inseparable from the configuration of existing political, economic, social, or

institutional dimensions. Ethics finds its possibility and meaning in the e-evaluation of how potentials are produced, distributed, or inhibited in the actual structure and formations of the world.

The configuration of existing institutional dimensions brings along the necessity of thinking ethics together with the problem of change. In this respect, the most fundamental difference distinguishing Massumi's project from contemporary theories of ethics is that Massumi's ethics are grounded in the excessivity of events and not in the already known structures of meaning. For this reason, in his theory of ethics, each value is a surplus-value, not of a particular thing, but of life. Inversely, life is not a particular thing, a substantiated life force. Life is a snowballing movement of the events' occurring, strictly dependent on their material conditions. What makes an event an event is that it does not resemble previous events under any circumstances, while, paradoxically, keeping a certain likeness to them. Each reproduction of likeness is the production of an indigestible aspect in its unfolding, which creates surplus-value. A surplus-value reveals itself in this world through the elements' performance an event brings into proximity, just as a color acquires its real, unique character only in concert with the relationships it enters with other colors in its vicinity. In this sense, (surplus-) values cannot be absorbed into generic values such as family values, democratic values, etc. (Massumi, 2017a, p. 345). Its likeness with the image of previously established values appears only as a problem. But even in this problematic convergence, the principal hands are reshuffled in the cut of the event. Even in contexts where value is settled according to its most generic character—the family, school, workplace, or prison, something happens and a new value arises. Furthermore, this happens all the time, whether we realize it or not. This eventful character of value shows that it plays an existential role in its life-founding, context-rocking character. Value is the outcome of processual occurrences, only defined by its movement of exceeding a given repertory of moral principles.

Certainly, some questions come to mind here. Is considering value through its uniqueness, its eventful character simply a presupposition, a transposition of a kind of romantic ideal into the axis of values, the pale echo of a phenomenological subject that somehow still manages to survive after deconstructive trimming? If both uniqueness and persistence are what makes an event and event, even and especially in fields where it appears as if “nothing is happening”, then how do we approach an event by remaining faithful to its dimensions? Would not this approach itself then constitute an event in its own right thus betraying its own faithfulness as an/to the event?

Following Deleuze's definition of philosophy as the creation of concepts, Massumi considers concepts as tools to be posited in a problematic field. For Massumi, concepts shouldn't be applied as if they are separate entities from their applied field but should be activated by delineating a network of questions in conjunction with the needs of the project at hand. According to Massumi, the condition of entering into a problematic field or even of its creation is to focus on an example. An example is what drives both the likeness and difference of a problematic field. It brings double progress. The elaboration of certain questions regarding Massumi's concept of value resonates in the example. Each detail in a considered example hits the problematic field of this example with a deviational force; they vary or modulate the conceptual landscape. In this respect, example and concept of value share a common point. They are both posed as the instantiation that priorly characterizes them, and immediately come in contact with the conditions that make them possible thus proliferating instances. This implies an affinity between the example as a field of resonations and the eventful character of value. But isn't there a paradoxical side in this kinship? Doesn't an example have to be an example of something, a type or model? Doesn't it necessarily express the apparition of a general instance in particular conditions? These questions no doubt have their answers in Massumi's texts.

Massumi's writing displays a multi-dimensional structure with multiple entries in terms of its diversity of the elaborations of conceptual problems in different topics and fields. As much as coming in contact with his thinking triggers a lot of excitement, passion, and the proliferation of different images, it also comes with its own difficulty. In a way, it is the difficulty of, to borrow Deleuze's expression, starting in the middle. On the one hand, we do have to start in the middle. Massumi's philosophy doesn't assume an originary starting point or a teleological destination. This makes all the elaborated concepts related to each other in one way or another. No matter where you start, you have to take into consideration many aspects of Massumi's conceptual palette, which makes things inextricably difficult to manage. On the other hand, this mutual implication of Massumi's concepts is actually one of the gestures of Massumi's thought: life's ceaseless production of surplus-values and their snowballing effects in becoming manifest themselves in writing. The condition of thinking life in its own eventfulness without presupposing an immutable driving force behind it is to consider at the same time its rebeginning in each event and the resuscitation of previous forms and structures in the middle. One must consider the relative or absolute distance with respect to them as to produce a surplus-value of life. Starting in the middle

means *participating* in the momentum of an ongoing movement. It means joining the propelling forces of forms inherited from a past already in the way of their self-exceeding, their becoming-other, and potential states divided into endless divergent lines in an infra-membrane of the present. Thus, thinking and writing cease to be the passive, descriptive device of the forms found in a pre-existing field but appears as an echo-chamber where the possibilities of becoming-other echo one another (Massumi, 2002, p. 159).

It is not just life that constantly proliferates itself without being reduced to an essence, the disciplines and fields of activity also get their share from this process. The fuel-provider of Massumi's philosophical writing is its symbiotic relationship with the non-philosophical. While the non-philosophical is folded into the philosophical, the philosophical participates in the conditions of realization of the non-philosophical in order to make a difference in the world: a double becoming. Mutual inclusion, one of the concepts signed by Brian Massumi, refers to the coming together of the philosophical and non-philosophical in the example. The philosophical and non-philosophical "fuse without becoming confused" (Massumi, 2014, p. 6, 34, 46, 67). What provides the conditions for the constitution of an example is positing it in a problematic field, varying itself detail by detail so as to make a difference as a self-relation, and in turn, varying with them. This methodological weaving in Massumi's writing, rather than being a strategy, traverses all his works. The detail, which runs as an engine of deviations in *Parables for the Virtual*, is "like another example embedded in it" (Massumi, 2002, p. 18). It is the "microexample... an incipient example", which "harbors terrible powers of deviation and digression" (p. 18). In his last book—*Architectures of the Unforeseen* (2019), this time Massumi emphasizes the variational character of the example:

Each example in the potentially continuing series includes all the others in itself, in that it implicitly presents itself as a variation on them -as they, should they eventuate, will include themselves as variations on the series. (p. 97)

Meanwhile, the ability of an example to propagate itself in a variational field and shake the integrity of each instance from within without completely destroying its consistency is what prevents the example from being wrapped in a single stereotypical, general idea:

No two [examples] will share all their defining characteristics in a way that would allow them to be subsumed unequivocally or without remainder under the same general idea. The

example, contrary to the common assumption, does not instantiate a type. It performs an immediately lived belonging to a lineage of typal variation. (Massumi, 2002, p. 97)

This is the point at which we see the affinity between the example and value. To the extent that the example is not an extension or application of a previously known or assumed thinking pattern, a value cannot be evaluated according to a normative ethics based on the priority of inherited norms (Massumi, 2017a, p. 361). Lived experience has a certain latitude whose presentational richness cannot be comprehended by the framework of already existing norms, which are not totally ineffective, but reconfigured each time according to the intensity of the lived experience. Intensity, one of the central concepts of Massumi, is often misconstrued as something unsullied by culture, something like the authenticated experience of *the* subject or the *raw* experience as the locus of the prelinguistic realm. On the contrary, according to Massumi, intensity concerns the compositional side of experience, how the elements that make it possible come together in their unique way. What gives an occasion of experience its singularity is this coming together, the coexistence of aspects traversing its fragmentary unity, their co-variation within a problematic field in which they gain meaning in an asignificatory regime. In other words, as Massumi puts it in *Semblance and Event*, it is “when a process tends to the limit of what only it can do, and in that act resonantly embraces its own range of variation” (Massumi, 2011, p. 84). The issue is clearly the ability and capacity of things, of what they can do, and thus, the issue of potential. The problem, however, is that “a potential does not preexist its emergence” (Massumi, 2002, p. 226). Although it cannot be predicted or foreseen because of its status of being prior to the coming experience and accompanying through it, it is the formative power of the experience thanks to the experience’s capacity of pulling itself towards its beyond. The cloud of vagueness that encompasses every experience unfolds the experience according to the ways potentials present themselves in the margin of uncertainty each situation harbors in itself.

One makes the transition from the primal feeling that an event is just about to stir (Massumi calls this incipency) to the classification of various action sequences into possibilities, and from there back to determinate forms. This sequence can only be understood retrospectively, however, and the final outcomes always find themselves in becoming. This gives us the opportunity to replay this presentation of the event, authorizes us to counter-actualize it. If determinate forms return to themselves always with a difference, then there are forces that pull them towards their otherness: terminus as an attractor. If possibilities are the sum of accidental circumstantial forces’ angle of

entry into a situation, then the situation itself consists of bundles of possibilities. Possibilities not yet explicitly invested and imagined as possibilities in their unfolding in the determinate forms. A potential is “a multiplicity of possibilities materially present to one another, in resonance and interference” (Massumi, 2002, p. 136). However, circumstantial forces hit the situation so singularly, intensively that their coming-together in sensation “cannot be exhausted in one go”, enveloping uninvested possibilities as potentialities. Thus, when a “potential strikes like a motor force” (p. 136), then it rhythmically emerges from one situation to another as overflowing the instant and rolling across them. This self-exceeding movement is called tendency. Terminus, potential, and tendency co-operate as to produce the problematicness of a situation. Therefore, the singularity of each and every experience, the emergence of irreducible qualities of life extend themselves to other instants and situations in the crisscrossing of problematic fields. The singularity of an experience is what just experienced in itself: the unexchangeable “currency” of experience (Massumi, 2018, p. 25).

Conversely, that an event’s unfolding in the experiential register carries excessive effect that does not fit into normative operations and useful functions also means that, within a retrospective gesture, the event can be captured and incorporated into these mechanisms. In certain ways, even the real energies that provide events their continuity are the processing of these potentials. This leads us to the second aspect of Massumi’s undertaking of positing the concept of value as the main axis of ethics. In Massumi’s analysis, neoliberal capitalism appears as the fundamental contemporary activity of capturing potential as a surplus-value. The most important feature of contemporary capitalism is that it invents and recalibrates itself by capturing potentials exactly at the moment they emerge. This means that there is a resonance between the qualitative side of experience that produces singular values and capitalism as a process that has the sensibility to capture the potentials at its spring. The surplus-value of life that is defined by its escape from given meanings, functions, and forms of the world, from the institutional, quasi-institutional landscapes *might* be converted into the profit-making systems. “Economization is the conversion of one kind of surplus-value (surplus-value of life) into another (capitalist surplus-value)” (Massumi, 2018, p. 20); “life activity is maximally channeled in keeping with demands of capitalism's self-driving” (p. 59). However, as the term “conversion” implies, the surplus-value of life and the capitalist surplus-value are not the same thing. Although the latter is dedicated to the capture of the first, it is the movements of escape that give the first its main character. This creates

situations that the neoliberal capitalism must constantly confront. As Massumi states by quoting Marx, these relatively divergent lines are located in the pore of capitalist society and carry the seeds of a postcapitalist society (p. 87). On the other hand, this interval cannot be consolidated into a programme, into the previously known action-paths that imperatively need to be followed, or a certain type of subjectivity. How potentials are born in a problematic situation, that is, according to which attractors the differential play of heterogenous tendencies are in-formed and under what conditions they come together should be re-evaluated case by case. This means that the lines of flight cannot be known in advance and the emergence and configuration of activities must be composed by a “processual-ethical evaluation” (p. 99).

Microbe-Artworks

Microbe-artworks problematize certain aspects of the neoliberal capitalism, sometimes directly, sometimes indirectly, based on contemporary microbial features. They experiment with the tendencies of capitalism by means of a certain economization of microbes. Analyzing these tendencies, and looking at the formations that present themselves as a problem in the composition of an artwork and their relationship with existing power structures also means to consider microbes as an ethical problem. How are the surplus-values produced in these works with reference to a certain microbially, as a result of certain scientific discourses and practices, and how are they distancing themselves to the existing field of activities’ institutional landscape? What are the formations into which the processual values underlying the artworks’ composition are actually or potentially channeled? To what extent do they overlap with or diverge from the norms of these formations? To what extent do the flows framed by scientific discourses and practices and incorporated by capitalist operations overflow the routes assigned to them? Finally, if ethics does not mean making a classification according to a pre-set system of judgment and the listing of right and wrong acts to be executed but refers to the evaluation of things’ capabilities in the processual unfolding of tendencies to be performed, what then is the meaning of expressing ethics in a thinking-writing space?

Microbial Currency: Raphael Kim

Undoubtedly, the question of value arose from the first moment research on microbes began, even with what Leeuwenhook called animalcules. In the beginning, this value might have originated from a fascination of the realization that there were microscopic creatures in the universe or it could have produced value as a matter of scientific research. Later on, it found its expression in the discursive, institutional, social structure and organization of life sciences and medicine in the diagnoses of diseases and treatment methods with reference to microbes. Then, the economical valorisation of microbes came, for example, through the pharmaceutical industry. In each of these fields, value sustains itself both by foreseeing the unleashing of certain potentials and by creating a sensibility to establish institutional mechanisms to reproduce it. Nonetheless, in all the fields, which? mechanisms determines how value is to be addressed, that is, how the promissory aspects of engaging in one or another type of activity with microbes can be revealed. Each field determines how microbes are e-valuated thus creating surplus-values (excess effects that guarantee continuity of activities' operation), making it the engine of their existence. Therefore, microbes' becoming value takes place over the field in question and in terms of it. In medicine, for example, microbes' becoming values comes from classifying symptoms and rendering them meaningful in the definition of disease, and in this respect, finding appropriate treatment methods. In terms of life sciences, the value is in formulating a question about microbes within a certain scientific framework, depending on the observations in the laboratory conditions to develop methodologies in which solutions will be presented. For the pharmaceutical industry, the value is derived from profit making by the development of products and services. These fields, of course, are not completely isolated from each other. A development in one area resonates in others and prepares the conditions for the reproblematisation of microbes' evaluation. For example, the results of a particular scientific experiment might concern the medical field and the pharmaceutical industry.

Here, I suggest that microbe-artworks emerge as an effort to make the microbe-oriented values visible as themselves, to give them an ambulatory range, irreducible to a single field. Microbes are value-able but the values need to be abled, preserved, activated, and re-potentiated, differently each time in the fields in which they are processed as such. In this section, I discuss the work of two artists—Raphael Kim and Kathy High, where microbes' promissory aspects are

emphasized. There is a side to microbes that exuberates in the fields that allow it to express itself and induce it to a wider social field. The circulation of microbes outside of these fields where they are already more or less coded creates problematic situations. The situation is problematic because the composition of the works both comes into contact with existing milieux and deviates from them in certain ways. A referenced scientific discourse or a scientific experimental protocol comes out of its embedded institutional, discursive, social, political locus and is channeled (transduced) to other ends. This channeled field as a separate field of activity is not defined through a predetermined institutional framework or in the finalities of a known field of activity. As such, the problematization of the work's problematization, in other words, the evaluation of which elements, according to what conditions and tendencies the work brings together raises the question of this composition and hence microbiality can do. The composition of the work resonates in a processual-ethical evaluation, which will find its expression in writing and in thought.

Microbes as Living Currency

Kim, who calls himself a designer and researcher, creates various designs and design concepts in the field of life sciences.¹³⁰ One such project of his is called “Microbial Money”. In this section, I discuss the concept of “Microbes as Living Currency” defined under the title of Microbial Money. Under this concept, Kim presents two works: *Microbial Money* and *Peck As You Go*. Before evaluating these works, I would like to unpack the choice of title—“Microbes As Living Currency” since it contains some clues to Kim’s approach to microbes as well as suggests a conceptual problem arising from attributing a role to microbes-being a living currency. Instead of simply accepting this title as metaphor, what would happen if we attempted to take it more “seriously”? What would be the implications of establishing an association between vitality of microbes and currency?

We find the expression “living currency” in authors such as Francois Fourier and Marquis de Sade in different contexts. Living currency, however, takes its most intense conceptual

¹³⁰ How people name themselves is important to me and I care about the differences between these naming. But I don't see a problem in calling Kim an artist because of the context of his work.

expression in Pierre Klossowski's *Living Currency* (2017).¹³¹ Klossowski analyzes the relationship between the monetary economy and an economy that can be called the economy of passions, through a special form of convergence between a counter-utopia and industrial production. In this period of production, human beings find themselves in the position of human capital. Klossowski posits that the fact that people can experience sensations, emotions, and pleasure makes them a currency since their feelings have value; as a result, they can be exchanged with each other (2017, pp. 72-73). While this is a counter-utopia, Klossowski insists that this dynamic is already at work in contemporary capitalism:

The whole of modern industry, even though it does not literally resort to such exchanges, rests on a form of trade mediated by the sign of an inert currency that neutralizes the nature of the objects being exchanged. It thus rests on a simulacrum of this kind of trade. (2017, pp. 72-73)

Money as an inert currency that procures exchange between different things, disactivates some parts that are inherent in objects, thus trimming the sensational parts that encapsulate human beings. In this way, they are transferred to objects and make them exchangeable with each other. The concept of simulacrum, which Klossowski deals with especially over the concept of eternal return of Nietzsche, expresses the incommunicable side of these passionate or sensational aspects (1997). According to Klossowski, passions and sensations are incommunicable because things, interpersonal relationships, and more generally, all kinds of encounters have a phantasmatic side. This is not simply an illusion or a subjective phantasm but a dimension that constrains a person from expressing themselves but cannot be displayed in a reproducible form precisely because this is felt in an irresistible form: “a willed reproduction of a non-willed phantasm” (Smith, 2017, p. 8). This is in fact a description of capitalist economy. The norms operating in the capitalist economy cannot avoid this neutralization even when they reach a self-generating plasticity. On the contrary, they have to hold onto it. Therefore, these two types of economics are much more complex than the relationship between political economy on the one hand and the libidinal

¹³¹ To try and understand Klossowski's concept of *Living Currency* I benefited a lot from Daniel Smith's introduction to the English translation of *Living Currency*, with the title *Pierre Klossowski: From theatrical to counter-utopia*, in Klossowski (2017).

economy on the other, and in a way presuppose and require each other. It is the ceaseless production of impulsional forces that make “objects of sensations” a currency.

However, these impulses cannot find their exact expression in consciousness and language. “Their number and strength, their ebb and flow, their play and counterplay” remain completely untranslatable to the terms of consciousness (Nietzsche, 2011, §119; quoted in Smith, 2017, p. 5). Moreover, it is their “laws of alimentation” that reveal the phenomena of consciousness. This makes them an economy that has its own laws, order, and dynamics of exchange. Hence the economic norms of capitalist society are “modes for the expression and representation of impulsive forces” (Klossowski, 2017, p. 47). Meanwhile, the impulsive forces remain largely unexpressed, so the expressiveness of this unexpressed margin accumulates in sensation, thus configuring an unequal exchange in the living currency. In fact, this is exactly what gives things the possibility to be commodified. There must be an incommensurable aspect of relative valuation of interrelations between things so that they can be determined by a third term, that is money, so that they can be rendered commensurate. This means that there is an aspect in the impulses that cannot be reduced to commodities, but can be converted to them, since it is inherent to them (p. 60).

Klossowski’s *living currency* functions as a kind of thought experiment, creating a situation in which the “capacity” of incommunicability embodied in humans begins itself becomes a tool of exchange. In a way, this means that the species called human finds itself in the environments where its forces are constantly translated into the terms of capitalist economy, but which has been surrounded by inhuman forces, and that it manifests as an ‘economy of soul’ in humans. The expression of this in the social field for Klossowski is the perversion: any kind of deviation from the already settled forms of the procreative function. Inversely, it is precisely these diverted energies that sustain capitalism; thanks to them, the subject of the economy of passion¹³², which is originarily cracked and fragmented, is transformed into unitary form as an economic subject, albeit momentarily. Although this circuit is established between impulsive forces outside of the scope of human culture and capitalist exchange mechanisms, the main medium of its driving force—

¹³² Klossowski prefers to use the French term “*suppôt*” rather than subject. Interestingly, this use resonates in Deleuze and Guattari’s analysis of the consolidation of unconscious processes in *Mille Plateaux* (1980, p. 44).

—the incommunicable, inexhaustible, incommensurable, or in the language of this chapter, the potential—is still human.

Accordingly, under which conditions does a microbe begin to host such a potential? What are the elements in Kim’s work that posit microbes as a living currency in a similar vein to the Klossowski’s use of the term? Considering that Kim directly associates the term with financial systems, what is the relationship of microbes as living currency with the capitalist economy and its potential deviations?

Currency Becomes Money: Microbial Money

Microbial Money is a speculative project that draws attention to the similarity between the uncertain nature of microbial populations and the operations of financial systems. Here, by “speculative”, I do not mean in the sense of making unfounded projections about the future but in the sense of using available tools to transform a situation that might happen in the future into a design. Kim carries this convergence, which has already entered scientific discourse, into effect with hands-on experimentation and scenario-building techniques. The resulting outcome is a tool that might offer investors an advantage in the financial markets by the use of microbes. The main purpose of *Microbial Money*, however, is to call to attention this convergence itself as a problematic, rather than offering an answer to a given social, cultural, or economic problem¹³³.

There is an unpredictable side to the behaviors of microbial populations that intersects with the volatility of financial systems (Maharjan et al., 2013). The unpredictability gives an emergent character to microbial behaviors, which inserts a potential margin of play between the observed behaviors of two microbial populations belonging to the same species. In a similar way, the volatility of financial systems designates a self-generative character of the economic value. Converging these two systems towards each other brings a bilateral investigation: the production of microbial potential and the nature of financial systems that generate value from “nothing”. And finally, the intersection of the two brings a resonance between a certain conception of microbe in the scientific discourse and the current organization of financial systems.

¹³³ <https://www.sciartmagazine.com/straight-talk-raphael-kim.html>. Accessed 12 December, 2020.

Two main axes of *Microbial Money* are hands-on experimentation and scenario building. The first one refers to Kim's biolab experience as a biodesigner. The starting point of the project is a scientific paper that makes a connection between the behavior of the bacterial populations and the financial markets (Maharjan et al., 2013). Kim pictures a situation that the promise of research might be realized by the use of the biohacking possibilities. Then, he turns it into a scenario depicted in photos. The scenario proceeds more or less like this: a biohacker has developed a kit that enables the use of microbes to predict the movements of financial markets. A group of brokers finds out about this and contacts the biohacker. The biohacker explains to them how the system works. In this way, a mechanism that contains microbes enters the agenda of financiers. The positioning of the microbe samples in an apparatus, the use of the mechanism, the interpretation of the results in the context of financial markets create problematic situations. We see all these cases in the photos. Brokers argue among themselves, try to reach an agreement or to make a decision, etc. Thus, the problematic activates a capacity regarding microbes' capabilities in terms of the functioning of financial systems and its transfer to environments outside of a laboratory leads to different situations outside of the research setting. *Microbial Money* captures three types of situations: the emergence of microbial potential, the emergence of the financial systems potential, and their encounter with each other in problematic situations, rendered visible by the design of the kit. From this point on, we can go back to Brian Massumi's account of the unfolding of the potentiality in the neoliberal capitalism. We understand that microbial populations have reached such a level that its potentials might be captured by capitalism. They instantiate this process of capture in their own way. Along these lines, the surplus-value of life of the microbially is converted into the surplus-value of economy.

Financialization of Microbes

Kim's work follows current scientific discourses and practices to some extent. But a certain point, at the point at which microbe becomes connected to the financial world, the biohacker figure comes into play. The figure of the biohacker straddles both the world of sciences and its uninvested potentials in the world that remain out of the scope of its activity. The encounter with financial capitalism arises at this point.

According to Massumi, the cutting-edge of today's capitalism is the machinic surplus-value of production. It finds its most intense form in financial systems. Here, the term "machinic" designates the existence of a process that will ensure the continuous production of surplus-value and the mechanisms that will sustain it. Surplus-value finds its expression in an expanded field of life. It is an expanded experiential field because life initiates the creation of new meanings, structures, and forms, inducing the "determinations to be determined" (Massumi, 2017b, p.130, 137-138; 2015, pp. 32-37, 214).

The essential characteristic of capitalism is that, since the 19th century, it has made the tendency of "creative destruction" its main engine, which is a tendency sensitive to reproduce itself with constant crises. For this reason, wherever qualitative surplus-value emerges, that is, literally everywhere, capitalism has a procedure of quantification suitable for it. With this operation it injects a potential into its mechanisms that maintain its continuity. But here the word "mechanism" remains narrow in explaining this process since there is something in the process itself that exceeds regulations and norms that the functioning of a mechanism presupposes. Contemporary capitalism does not only "capture [the potentials] in different instances" (2018, p. 54), but with the same stroke, also brings about the creation of institutions, mechanisms, or norms where the processing of potentials will take place.

One of the examples about capitalism's capacity of capturing potential Massumi gives is biotechnology. Because productions based on the biotechnological "reembodiments" instantiate the triggering of a potential yet to come, which leads to a cascade of events. "Biotechnological reembodiments ... are less made than made to take form, by manipulating how potentials come to express themselves" (Massumi, 2017b, p. 13). In the case of microbes, the creation of an environment in which they can express their potential takes place differently than the logic of "to make to take form" or manipulation. Everything works through the unpredictability of microbial populations, behaving as a mass, a multiplicity, which arises from the interactions between different species. When the sciences manage to establish an appropriate discourse and methodology in order to explain this, it is precisely an "event of surplus-value of scientific knowledge production" (Massumi, 2018: 44). In this way, science approaches to the qualitative limit of a microbial field. Rendering the surplus-value of life measurable and bringing quantifying operations into play starts but doesn't end here. It doesn't end here because the birth of quantifiable

elements and microbial variables is essentially dependent upon immeasurable excess, just like in Klossowski's living currency cannot be fixed to a formula, or in the observable, describable effects that are induced by microbial aggregation. It varies according to the samples of microbes, the environment from which they are taken, and the scientific procedures and techniques they are treated accordingly. If we have to talk about a formula that explains the emergent behaviors of microbial populations, it is a formula similar to oracle's predictions and fortune-telling secrets. It is here that the figure of the biohacker steps in. Unlike the sciences, biohacking practices have no prejudice against discourses and practices labeled as superstition. The biohacker "sees" the repercussions of such a potential in a wider field, which is not yet known where it will be channeled. Here, Kim's project advances this idea and develops scenarios about what effects the installation that would unleash microbial potential would bring in the social field. The tools developed by the biohacker draw together the incommensurable nature of microbial potential with the volatility of financial systems. As if playing the role of an oracle, the tool may make predictions about the unpredictable financial movements by using biological means. The formula works. And the financiers know about the situation somehow. It is not at all coincidental that they'd be aware of this situation one way or another because we already know about the complicity between capitalism and the sciences for a long time. The path, however, is never linear and there are always leaks. "The movements of escape composing neoliberalism's immanent outside constitute a primary resistance to capitalism" (Massumi, 2017b, pp. 65-69). Although it is impossible to fix these escapes in a program, in an institution, capitalism leans on them as the requirement for its appetite for "creative destruction". Biohacking presents a problematic field for capitalism's sensitivities for capturing potentials. "*On questionne l'oracle, mais la réponse de l'oracle est elle-même un problème*" (Deleuze, 1968, p. 188).

Biohacking as a problematic field does not fully follow the channels of capitalization that have already injected into the sciences (through the funding of research projects, cooperation with companies, etc.). On the other hand, this does not mean that biohacking is completely outside of capitalism. This is exactly what makes it problematic: biohacking has not yet entirely become part of capitalist cogwheels but it is already moving on that course. Norms have not fully settled yet but are at the stage of formation. Cogwheels don't work perfectly yet, failure is an immanent aspect of potentialisation. But when the biohacking mechanisms work, they take the capitalist system one

step further. Actually, nothing is straightforward, everything is in a fragile balance, making it necessary to test these delicate waters.

It is not at all coincidental, therefore, that Kim's project is sometimes described as "dystopian"¹³⁴. When the unpredictability of microbes joins the biohacker's lack of institutionality or semi-institutionality, disaster knocks at the door. Let alone how biohacking may allow one to gain an advantage in the markets, the whole of humanity could be dragged into a destructive crisis. Undoubtedly, it is worth taking the risk. In any case, isn't playing the stock market an act on the brink of destruction? While stakes are established between absolute gain and total destruction, many other situations arise in between.

In the absence of predictability of norms and the ordering of regulations, users test the effectiveness of biohacking tools and the possibility of new forms of sociability by engaging in various interactions with each other. Every photo in Kim's script building shows these problematic situations. The financiers that analyse the stock market via pipette, conducting alleyway experiments with propane and making backseat bacterial deals. Or they pray to the micro-oracle because the only thing they can do in this environment of uncertainty is have a *belief* in this mechanism. The main goal in Kim's scenario is to undoubtedly instrumentalise microbes and gain advantage in the markets by using them. However, the situation framed by this instrumentality—the resonance between the emergent effect of the microbial populations as a surplus-value of life and the volatility of the financial systems, invalidates an absolute instrumentality to the extent that it does not allow for complete conceptualization. It translates and incorporates a kind of uncanny feeling that comes with microbes into the awareness and capture of their potential. This is what makes *Microbial Money* a speculative design: by using the tools available to demonstrate the problematic nature of events that do not exist in the present but may happen in the future. The resonance of microbes with financial systems makes them a value in themselves, outside of the current paradigms with which they are addressed. Thus, their value would be included in the circulation where it will intersect with different surplus-values such as surplus-value of perception, surplus-value of sociality (Massumi, 2018, p. 32) and eventually be a part of the value generation mechanisms. Another project by Kim—*Peck As You Go*, speculates on what kind of circulation

¹³⁴ <https://raphael.kim/biohack-the-economy>. Accessed 12 December, 2020.

<https://www.sciartmagazine.com/straight-talk-raphael-kim.html>. Accessed 15 December, 2020.

systems that considers microbes as living currency in another context would bring forth. This time, microbes find their value in human fluids—the spit and the value is problematized through the kissing act, an intimate act for human beings, serving as the locus of microbial potential.

Circulating Microbial Money: *Peck As You Go*

In *Microbial Money*, we have seen that there is more of a reciprocity, a resonance between the production of microbial value and capitalist systems rather than a containment relationship. While the emergent effect arising from microbial interactions has made the whole microbial field valuable in its own right, value is perceived by the neoliberal capitalism, which has historically made itself sensitive to the production of excess. Although this perception has not yet transformed into a complete consolidation in institutions or uses, it presupposes a field of experimentation: the founding moment of capitalism's self-production. This is exactly what distinguishes Kim's work from technological design. It is designed for use but the social environments in which it will take place are not fully established. The potential instrumentality attracts financiers but the manuals are not yet stable. What channels the value will follow to be integrated in the circulation circuits towards its finality that is the economic conversion of the surplus-value of life into an economical surplus-value. *Peck As You Go* catches the journey of the value towards its terminus this time in the realms of the personal.

In *Peck As You Go*, we see an organic substance—spit considered abject in human culture become a value in terms of the microbial presence in it. The design of the project was once again inspired by a scientific paper (Kort et al., 2014). The microbes in the spit can be detected and their interaction can be quantified. As we have seen in *Microbial Money*, it is essentially the qualitative that is quantified, a certain state of the interactions of microbes with each other depending on the environmental conditions. Quantification is the packing of a microbial dynamic in the scientific expression that takes a snapshot of the transition of microbial interactions. *Peck As You Go* takes a stand-still from a cinematographic field (microbial dynamisms) into another cinematographic field—the social field on which interpersonal relations are based, in order to create a new image. Look at an act described as “intimate” such as kissing from a microbial perspective! Approach social environments in which kissing finds its meaning through the value coming out of microbial

exchange! And if this sounds too instrumentalist, then go even further and ask for the microbial bank statements of your kisses!

We can address two problems for the attribution of an exchange value to the microbial field and its coding as having a monetary value. First, the social meaning of kissing and the direction that it takes with the injection of a microbial value in it. Moving two types of qualitative values, one is derived from the social and the other from the scientific, to a measuring device, that is, once again the problem of instrumentality. The second is the digitization of data and its storage and circulation without the need for an intermediary organization.

Here we return to another example from Massumi. In *The Evolutionary Alchemy of Reason: Stelarc*, a chapter in *Parables for the Virtual* (2002), Massumi analyzes the work of the artist Stelarc. He gives an example of a flower while discussing Stelarc's eyeglass design that mimics the sight of a bee. A human and the bee perceive a flower in different ways within the scope of the mechanisms by which evolutionary processes assemble in their bodies. Although Massumi analyzes the case through the faculties of sensation, perception, and thinking, he does not consider the case as a phenomenological problem. What happens between a human and flower, bee and flower, or between a human and bee cannot be explained based on the transcendental structures of the phenomenological subject. Flower as an inexhaustible problematic (see relational) field, mobilizes different tendencies in human and bee, sweeping them in the same movement; so that they afford different kinds of actions. But even after perceptions are channeled into action-reaction paths, a latent side of the flower's relationality persists. Latency is not a hidden truth that can simply be unveiled by reasoning and can be revealed in one move. "Latent in the flower are all of the differential conjunctions it may enter into" (Massumi, 2002, p. 92). That is, latency refers to the inexhaustible reservoir of potentials of the flower. A human can turn them into processable possibilities in the structures of human culture by following a path that its own faculties have already harmonized. For example, pollen extraction becomes feasible by following various procedures in line with various purposes. While this is a narrowing of floral potential in terms of the scope of human culture and its activities, the injection of the potential into the culture promotes the mixing with other tendencies in the different parts of the ocean, with other capabilities. The potential, which is narrowed by possibilisation, finds the opportunity to (re)potentiate in the environments where it is channeled. For example, the properties of the extracted pollen will be

examined and classified, so that its network of relationships, which include different capabilities in other fields, will thus induce other linkages. The more the patterns of perceiving a flower become uniform and repeatable, the more the extraction and processing of potentials is regularized. Therefore, potentials are made available for use thanks to the systematic operations of simplification that make the anticipation for the future more and more perfect. “A greater co-presence of possibilities that enables a systematic construction of a combinatoric, and, by virtue of that, a calculated choice between possible next connections” (Massumi, 2002, p. 91). Now, the particular qualities of the flower in its generality are available for use. For example, the pharmaceutical industry can develop various drugs or products. A certain form of human relationship with flowers has been consolidated into a certain type of processing, from the contouring of perceptions to the unfolding of certain action paths, and thus, instrumentalized.

We can reconsider this example through microbes and Kim’s *Peck As You Go*. Although the microbes’ situation is somewhat similar to the flower, there are also significant differences. Human beings’ ways of perceiving microbes can take place only through certain technical tools and contexts, which requires a certain systematic and methodological approach. This gives a certain priority to sciences. But the scientific enterprise also has its own unique (re)potentiating techniques, and thanks to these, our perception of nature and microbes is diversified. As a result of this diversification, it becomes possible to approach the preestablished coordinates of research to the relational field of the investigated “object”. Meanwhile, the possible context of use of microbes was very strongly determined from the onset. The view of microbes as disease-making entities has dominated scientific discourses for a long time, and as a result, conditioned our perception of microbes. Accordingly, this has enabled certain types of products to appear in the social field, for example, in the pharmaceutical industry. The scientific work that inspired *Peck As You Go* focuses on the interactions between human actions and microbial populations as an extension of ecological discourses that change the views on microbes to a certain extent. The main focus of the study is that these interactions can be quantified. Kim attempts to reverse this operation and looks at it from the perspective of the social environment from which it came out.

If, as a result of kissing, microbial distribution in the body changes for the kissing parties and it is possible to quantify this change, what then would happen if we took this determination to its default conclusions and made it fully instrumental? How can a microbial potential that is

digitized and channeled into the cultural field be (re)enabled, that is, become a subject of use? What if we had a gadget which gives us the immediate numbers of microbial distributions after a kissing session? In this project, Kim mounts microbial potential by digitizing the data obtained after each kissing session. Two fields that can be called analog—the microbial field and act of kissing— become representable in a digital interface. Two questions arise here. First, what does this transformation say about microbial potential? Secondly, what is the point of having such information about kissing? In other words, what kind of use emerges in the invention of such a tool?

Massumi defines the analog as “a continuously variable impulse or momentum that can cross from one qualitatively different medium onto another” (2002, p. 135). The analog designates continuity of transformation. On the other hand, the relationship between instrumentality and quantification is immanent to the travel of impulse. “Quantification participates in the mode of thought commonly called instrumental reason (the thinking out of possibilities)” (p. 136). In *Peck As You Go*, the instrumentality has two directions. Firstly, microbes are considered as instruments. After each kissing session, the microbial distribution in the bodies can be measured. Secondly, as a result, two types of analogs come together: microbial and social. The field of use of this conversion, however, is not clear yet.

By the use of this device, kissing gains a different meaning on the social plane. The conversion of value into measure can now be instrumentalized one more time, once again by bringing the monetary value to the agenda in the form of bank statements of kissing. Although the results obtained with each session vary, displaying the results might effect the experience of kissing if the tool is instrumentalized under the right conditions. We don’t know about it yet. The microbial change becomes part of the performance of the act of kissing. It is as if we are kissing with all our microbes while we are kissing. We can also add other microbial effects to this, their organismic effects, or the fluctuation of moods according to the microbial redistribution, etc. Perhaps, in time, these effects may become a part of *Peck As You Go*’s apparatus as well.

We do not know exactly how to use this tool. But by positioning microbes outside of their contexts, the value they gain through an excess effect derived from the sciences opens different channels for them in the social field. How will this value be evaluated, according to which ends, which areas of use, and therefore, what kind of use-values will it bring and for which

institutionalities? Kim's design still sees microbial potential as a living currency in terms of exchange-value. It is designed as a payment system. Although the organizational structure on which capitalism depends on is disconnected from the design, the assumption that surplus-value can only be sustained through an exchange system keeps it in the orbit of the apparatus of capitalism's capture. Although the design carries an artistry that requires the invention of its use, it is not difficult to imagine a capitalist product in which it can be invested. On the other hand, observing the possible dimensions of the surplus-value of life that would makes such a product itself possible and its transformations is the essence of the ethical approach outlined in this chapter. The point is not to place ethics on a template of good and bad but to draw out a diagram of its capabilities and affordances while observing its blockages, inhibitions, and different phases of transformational processes. In order to better display this meaning of ethics and to establish its relation with writing, we need one more example. For this, interestingly, with Kathy High, we return to the preliminary context of this project, microbes as disease-making entities.

The Promise of Microbes: *You Are My Future* by Kathy High

In this last chapter, in a way we return to where we started: the context of disease and the conception of microbes deriving from it. After all the stages we have passed, although the name of the term microbe remains the same and its consideration refers to its primary context from which it has arisen, we will see in fact that everything is completely different now. We return to the context of disease, but this time, from a place where microbes become a value *per se* and in an instance where microbiality makes fully visible its flight from settled formations anchored in the world. The proposition we mentioned at the beginning of this chapter that the existence of microbe-artworks is founded on an ethical problem becomes clear in this flight. The question "what can microbes do?" finds its answer in its e-valuation. High's various projects gathered under the title of *You Are My Future* will be discussed in this context. Microbe-artworks grounding themselves in an ethical inquiry also reveal some aspects of an echologic research style and the process of thinking-writing it activated. This will offer us an occasion for drawing the outline of the conception of an echological writing as the science-art interaction appears in the microbe-artworks.

A Step Back: *Embracing Animal*

All becoming is a becoming-minoritarian... Becoming-minoritarian is a political affair and necessitates a labour of power (puissance), an active micropolitics.

Deleuze and Guattari, *A Thousand Plateaus*

The Rat Love Manifesto, The Politics of Empathy, written by High as part of her *Embracing Animal* project begins with this quote¹³⁵. High works with transgenic rats with rheumatic disorder. The aim is to observe how autoimmune reactions occur as a result of changes made in their DNA. The existence of mice is shaped around scientific objectives. These objectives are developed for pharmaceutical research studies in systemic inflammation. The marks like holes in their ears and yellow markings on their fur are a classification system for their identification¹³⁶. Meanwhile, High's interest in mice extends outside this frame. The aim is not simply to observe the mice, to link their behavior to certain unchanging principles through these observations, and to draw a route to human actions from there. The aim is actually quite simple: to establish a space of interaction with another living being in an uncomfortable situation and create a climate that opens out of given patterns of emotion, thought, and action in the human world. To the extent that such a climate is created, the conditions of "real" communication between human and mouse may come to light. It might be passed to a level that the mouse in the human and the human in the mouse can sense each other. Undoubtedly, the installation of such a climate is not without some functional goals. The vivacity of transgenic mice shows itself in the first instance through the symptoms of physical discomfort. Autoimmune disorders, which over the years High developed due to the Crohn's disease, provide a kinship for her in terms of the perception of these symptoms. When the mice need rest, when they have fever or ache, High *feels* them and acts accordingly to relieve them. This is a mode of relationship that extends beyond a "pet" relationship with animals. This relationship mode is organized around "empathy" with the animal, but through the shared situation of uneasiness, it expresses an aspect that removes the comfortable, carefully calculated distance of the human from the animal and exceeds the identifiable characters of "mouse-ness". Now, mice

¹³⁵ <http://www.embracinganimal.com/ratlove.html>. Accessed 10 January, 2021.

¹³⁶ <http://www.embracinganimal.com/ratlove.html>. Accessed 10 January, 2021.

are not simply objects or toy animals for humans but “extensions, transformers, transitional combined beings that resonate with us in ways that other animals cannot”¹³⁷.

Empathy as the entry angle of transgenic mouse-induced relationship immediately finds its meaning in another value: care. Alleviating the pain of mice as much as possible, strengthening their life conditions screws off the anthropomorphic aspect of human-mice relationship. It paves the way for that singular mouse expresses itself differently than all the known mice. In a way, its expression is the preparation of a mouse language. As an interspecies communicator stated in the context of the project:

The rats don't have a lot to say but what they do say is very strong. They speak to me as a group. They say that they are very happy receiving all the love and care you [High] give them. They like humans and are studying them as well¹³⁸.

Therefore, this relationship of love and care that develops with empathy opens up to a two-way transformational process: human-rat transcommunication in which the two sides mutually study each other and eventually leave the context of disease for the sake of playfulness, even if the former does not completely disappear. All of this happens in a lab environment transformed into a kind of art gallery that High's personal experience cannot encapsulate solely in the authorial artist subjectivity. Visitors feel “the tension of exchanges, transitions and trans-play” in this environment. Thus, this attempt, whose artistry arises in the climate it creates, is not simply based on the denial of scientific activity, but on the assumption that other modes of relationship are possible only when and where they are studied and eventually invented in some way.

In *Embracing Animal*, High incorporates her personal experience of Crohn's disease into her artistic practice. However, this desire to transform the context of the disease into an artistic activity in an affirmative manner reaches its highest level with the entrance to the microbial field. It is possible to understand this affirmative aspect even by the existence of the related projects that constantly reproduce and diversify themselves. Even following the emergence of these projects in a linear historical sequence can reveal how a profound relationship has been established with this field. To take another route instead. In the next section, I will focus on the notion of abject, which is considered central to High's projects in connection with Crohn's disease, as the entry point for

¹³⁷ <http://www.embracinganimal.com/ratlove.html>. Accessed 10 January, 2021.

¹³⁸ <http://www.embracinganimal.com/ratlove.html>. Accessed 10 January, 2021.

the problematization of the various concepts in the *You Are My Future* project. My main purpose is to show how the ethical sensibility mentioned at the beginning of this chapter works as the finality of microbe-artworks and to establish this sensibility's link with writing, which is in turn the finality of ecological research itself.

The Paradox of Abject

Crohn's disease is an inflammatory disease. Although it is not exactly considered an autoimmune disease, it is known it concerns the immune system. This makes it something directly related to defecation. For someone who has Crohn's, their relationship with the stool is crucial. It directly affects their quality of life, even their mood. Meanwhile, it is never entirely personal. The material processes and cultural representations about Crohn's have placed it into the interest of various disciplines such as history, anthropology, sociology, and even psychology. High turns the diversity of the representations of feces into a collaborative project with STS scholar Guy Schaffer through Dominique Laporte's stunning book *History of Shit* (2000). In the *History of Shit*, Laporte examines how attitudes towards feces have changed since ancient times and what emotions and representations shit has produced in different cultures, the processes implemented for its collection and grinding. In this respect, according to High and Schaffer, gut microbiome research might also represent a critical moment in our attitude towards it. In their project that shares the same name as Laporte's book—*History of Shit* (2017), one aspect focuses on this historical change, placing the gut microbiome research setting into a historical landscape¹³⁹.

Another aspect of the project coincides with the idea of creating a speculative history. As Laporte shows in his book, the relationship people establish with their own feces and the way they deal with it do not follow a linear course, and the emotions, meanings, or practices vary from time to time, place to place. By adding a feminist and queer perspective to this discontinuous understanding of history, High and Schaffer excavate the not-yet-written historicity of the gut microbiome research history. As in all historical narratives, the history of medicine and related scientific fields is written according to certain perspectives as to include certain focal points. Feminist and queer approaches reveal that the history is never neutral and that women and queer

¹³⁹ <https://www.youaremyfuture.com/history-of-shit>. Accessed in 20 January, 2021.

identities are either excluded from its biased course or subordinated to it. However, history could not have been realized only on the basis of written history. When we replay history with a sensibilities prompted by these approaches from today's practices of exclusion or neglect, we discern that history navigates its course actually very "differently" and there is always a feminist/queer crack at play rupturing the consolidated strata of culture. We even realize that this is essentially the driving force of medicine and science's progress.

The character Challis Underdue, created by High and Schaffer's *History of Shit*, represents such a crack. Underdue differs from established medical beliefs and protocols of the 19th century with her excremental vitality theory. Her approach reveals, as if sensing the theories of the 21st century's gut microbiome, that the excrement is endowed with special powers and that this is of great importance in terms of health and well-being. Underdue represents "a kind of intuitive understanding of what was happening in the history", in the words of High¹⁴⁰. Thanks to glass colon replicas Underdue creates through fermentation experiments (exhibited as part of the project), she develops a "tactile" understanding of the human body and originally depicted the bowel functioning, echoing contemporary microbiome theories.

Consequently, High and Schaffer's *History of Shit* focuses on two different aspects. The first is the history of coding feces as something that should be discarded not only physically but also culturally, that is, as an abject object and the change in historical approaches. The second, with an inexistent (speculative) history which postulates that excrement has its own value, on the parallelism between the exclusion of excrement as abject and the exclusion of woman and queer subjects from history. These two sides continue to come together in different contexts in High's projects, especially her research on the microbial field. In a way, what gives ground to these projects is the tension between these two aspects and the various modes of research-creation that emerge from this tension. We can also consider this tension conceptually as a sort of paradox. On the one hand, the feces is coded as abject in cultural representations, on the other, the coding takes such forms in history (*shit* for instance as an object of desire or a fetish object) that some aspects of the abject have to be recognized as a value *per se*.

¹⁴⁰ Personal communication with the artist.

The abject associated in relation to Crohn's disease and feces includes these two aspects in accordance with their own conditions. While the "unpleasant and degrading" side of the abject is felt in a certain way in the experience of the disease, this feeling cannot be taken as a simple analogy of physical discomfort. The abjecthood that emerges in the experience works as the registry surface of a complexity, implying heterogenous elements. It in a way produces a fascination: the possibility of being opened into a wider field that cannot be limited to the effects of disease and the birth of a research-creation impulse that will unfold in the process towards the discovery of different modes of this field.

Though closely related to Crohn's disease and gut microbiome research, therefore, another field of engagement extends beyond it. Here, the paradox of the abject— the simultaneous positioning of the abject as an unpleasant feeling and an object of value is performed in High's projects in certain ways and with different accents. The tension between the two aspects of the abject is resolved in certain ways in each project, making microbes a value in their own right. Undoubtedly, engaging with scientific activity is a crucial piece of the process. The meaning of the microbial field to which this abjecthood refers would be flattened by scientific operations, rendered anonymous and impartial beyond morality. However, at the moment this process is completed, that is, when it is re-injected into the social field, the tension is reproduced by other means and the ingression of microbially re-characterized. This brings about a reassessment of the moralistic semantic structure that the term 'abject' includes from the onset and, in this respect, turns it into an ethical problem.

The emergence of value in this process is freed from its imperative bonds mentioned at the beginning of the chapter and escapes from the reception and re-production of moralities as coded in relation to inherited forms. The displacement of codes according to characterized situations appears as a (re-)valuing process. Ethics as the revaluation or creation of values. The paradox of abject goes through Crohn's disease and gut microbiome research and spreads microbially to different social formations by resolving the paradox in different ways. High's projects participate in the process of objectification of the abject through scientific channels and also in the lines extending them to other social formations. In this way, they bring into view the artistic process with respect to microbially. However, this process is needed so as to traverse through High's other projects.

From Abject to Object: Abject Object

Since the way science establishes its own activity is already based on a certain claim to neutrality, a morally charged notion such as abject does not apply to the sciences. What is encoded in a culture as abject enters science through Crohn's disease symptoms and is considered as a malfunctioning in the human gut. It is the not-yet explained, not-yet contained of the sciences that often appears in the form of a question. Gut microbiome research, in accordance with the status of the paradox of abject that combines exclusion and value, both positions unknowability as a part of its research regime and opens up a promissory future depending on its propositions. The social, moral, institutional etc. status of the abject is neutralized by scientific procedures. Conversely, the same operations charge it as non-abject with other values, this time not yet moralized. It appears in the first place in the discursive framework of the gut microbiome research. Invisible microbial activity produces an internal value for different ends. The guts are home to some of the largest collection of microbes. They need a rich network of underlying blood vessels to carry nutrients. Microbes have a share in all these essential properties that make them valuable for human health (Fraune and Bosch, 2010; Sommer and Bäckhed, 2013; Stappenbeck et al., 2002).

High does not look for the value of microbes merely in scientific discourses and establishes her engagement with sciences and scientists in her works within a certain ethos of collaboration. It is necessary to learn from scientists and to combine what has been learned with other sensibilities and intuitions and relay them to the projects. In the first place, explains High, "we know how little about them, although we live with them all the time"¹⁴¹. So, "developing an affinity with them is a big learning. How they live, how they communicate, how they share information with each other".¹⁴² Yet, learning and relaying do not simply consist of a linear transfer of knowledge. This is itself a problem for High. It is necessary to learn from the sciences and create the basis for project ideas, and the scientific discourse must be simplified and popularized. To intervene in this discussion, High returns to her proper resources, kept always in potential during her career: documentary movie. In *Fecal Matters* (2018), High interviews scientists in the field of gut microbiome studies and fecal microbial transplants. The documentary doesn't consist of only the accounts of scientists but also of animations, personal histories, different forms of narrative, etc.,

¹⁴¹ Personal communication with the artist.

¹⁴² Personal communication with the artist,

which adds different dimensions to the investigation of gut microbiome. Therefore, it is not simply a simplification of scientific discourse for the larger public: “I don't think that this work that I'm doing, what would fit into a science communication area. I think it's beyond that.”¹⁴³

High talks with scientists in the field, observe their practices, and tries to understand “promising” treatment ways and their potential uses that are still in an experimental phase. The idea of fecal transplant comes to the fore in this way. If there is a certain correspondence between the gut microbiome of a healthy person and someone with Crohn's disease, then a sample from a “healthy” individual could be injected into the diseased person. In this way, two microbial ecosystems interact with each other in the gut of a diseased person. As a result of the influence of the healthy microbiome, a new flora might emerge, which would potentially cure the disease. Since microbial ecosystems are quite complicated, the criteria for transplant and the conditions for definitive success are not clear yet. In this sense, the proposed treatments still carry a margin of experimentation. At this very point, the obscurity of the situations in which two microbiome “correctly” interact, radically change the landscape of the diseased fauna, and finally totally cure the disease makes each microbial sample valuable. If you keep your gut microbiome under appropriate conditions, one day it might be useful to other people and the same thing is relevant for everyone as well.

High embraces the uncertainty. She learns from scientific theories and practices and applies what he has learnt to her projects, under different conditions. In each project, the engagement with sciences takes a different form and different dimensions are added to it, either by alternative practices in the absence of the pillars of scientific organization or by the design of different tools and objects.

For example, in the *Family BioCrest* (2017) project, the visibility of the interaction between microbes in terms of interactions between human individuals sharing the same environment is examined. “I want to discover if family members share similar (or dissimilar) gut microbes because they share (or shared) a living environment, thus possibly giving families a particular gut bacterial/fungal community signature and profile”.¹⁴⁴ The presence of microbes in the human gut cannot be framed in negative terms since they play crucial roles, for instance, for the functioning

¹⁴³ Personal communication with the artist.

¹⁴⁴ Personal communication with the artist.

of the digestive system, or have an impact on the mood. But the observation of such effects only arises when they are part of a particular scientific setting.

However, microbes continue to interact with each other and affect human individuals in various ways in very different situations and environments, depending on lifestyle and environmental conditions. Here, *Family BioCrest* visualizes microbial diversity and communality and raises the possibility of a different kind of observation. How is microbial activity dispersed in creatures that share the same house? Can the complexity of this activity be translated into a profile for each individual? And in the end, can it be understood as a signature as implied in the term “family bio-crest”? High’s ongoing project brings together the diversity of everyday life with laboratory techniques, making the complexity in the human gut flora visible as part of human interactions with each other and with other living beings.

On the other side, Crohn’s disease continues to be part of High’s research agenda. Her *complicity* with sciences is indeed an occasion for High to also understand her own situation. But she doesn’t frame it in her work in personal terms. She takes her work as part of a wider inquiry, transforming her body into a “site of experimentation”.

With *Testing the Waters* (2017), the discovery process opens up to systemic elements. High worked with DePaolo in William DePaolo’s lab at University of South California at the Keck Medical Center for one month. For High, the biology laboratory is important: “being in the lab is valuable for me, to not just speculate about the work, but to be able to understand how these microbiomes are growing, are smelling or reacting to the things we’re doing”¹⁴⁵. She conducts experiments with De Paolo to understand and visualize how High’s T-Cells react to fecal matter. They take their white blood cells and introduce to their feces H2O and assays to their cells. Then, they visualize the result through a microscope. The result in High’s agar is quite striking as compared to DePaolo’s blood cell reaction used as the control subject. A huge “angry” black dot can be seen in the image showing the T-cells breaking down other cells. For High, who has now seen for the first time with all its clarity how her immune system works against itself, this is both a frightening and poetic situation. Frightening because the black dot in the image is the simplest expression of the discomfort caused by Crohn’s disease. On the other hand, it is also poetic because

¹⁴⁵ Personal communication with the artist.

it is an expression of microbial relationality that the relationship between microbes, and organismic and microbial activity continue to be related to “bodies, ecologies, climates and so on”, even though it creates discomfort in the organism.

Now, this image brings together the two different dimensions of our relationship with microbes through disease, the microbial activity becoming palpable even for the human senses, and the place it holds within the landscape of medical discourse. The poetry derives from this. High’s consideration of this image as a glitch is also related to this poetic aspect. The glitch is not simply a contingent impairment of systemic operations. It is a systematic but productive moment of indecision. The opening to a transformational space and a broader entanglement is enabled by a suspension, a kind of a constructive suspense. It is not simply an inoperability of the organism that it perceives itself as an enemy and attacks itself. “I am mutant, preparing for another time” says High¹⁴⁶. The artistic enterprise and the science-art collaboration is a complicity for this another time.

“Another time” is the promise for the interaction of the infra-organismic dimensions of the organism in an imperceptible interval. A moment that gathers in itself the complexity of the whole ecological entanglement anticipates the activities’ self-exceeding movement, dispersed over the whole human culture. It is not an ultimate resolution of the paradox of abject but the excavation of an interval in which it will re-energize itself by other means, under other conditions. A tearing (*dé-chirement*) that takes place in the temporality of our thinking-doings in the world; a small, modest rupture.

I wouldn’t hesitate to call this original temporality a microbial temporality. The temporality of the sciences’ engagement with microbes through which their species qualities are attributed, the multilayered temporality of the cultural representations of microbe, the temporality of actions in the laboratory environment, or the temporality of sensibilities that lead an artist to produce a project related to microbes. Neither nor, but an irreducible temporality that arises from their processual coming together and the spatiality formed by their entanglement in an outcome. Processual coming-together is time itself. Traversing the spatial arrangements and wandering the rhythms that connect them. Approaching to or moving away from familiar forms, structures, and meanings.

¹⁴⁶ <https://www.youaremyfuture.com/testing-the-waters>. Accessed 1 February, 2021.

Echology and its mode of conducting a research through the implication of an echo participate in this wandering through the excavation of a writing space. It begins with more or less arbitrarily selected examples, then proceeds by grouping, separating, and measuring the distances that will yield the problematic fields. Actually, the problematic fields are there already or in factually barely there as constellations, constantly pulsing signs.

Crohn's disease provides a problematic field for High. The signs of this problematic field appear under the form of symptoms. The symptoms are also what attracts her to the investigation of other problematic fields with which the problematic field at hand is implicated. Scientific practices enable a certain understanding of microbes. And if you spend enough time in a laboratory in order to understand how microbes operate, then an immanent understanding of their behaviors emerges through "care". "The care part is the biggest question. Because we don't really know how to take care of microbes in the gut microbiome".¹⁴⁷ In return, microbes yield an image that creates an awareness, a sensibility about ecological entanglements, a weaving of problematic fields. Or, considering the transitions from one problematic field to another, we can call it an ecological entanglement. If the signs that come with a particular symptom or a particularly observed microbe behavior as a result of certain scientific procedures are pulsed, then the transition from one sign to another in the problematicness of an echo is not pulsed. Pulsed and non-pulsed, interweaving of echoes echoing each other in the problematicness of writing. An echo perpetuates in this way, until it reaches another echo. It extends itself to another echo through the various modes of relationship with it. A rhythmical field that consists of accelerations and decelerations, their articulations and dissolutions in the unfolding of a problematic field. Echology as a complex of echoes.

We have one more stop on our way before we bring all these concluding points together.

Art's Wandering in the Cracks of Sciences

The relationship with Crohn's disease cannot be separated from scientific developments and the therapeutic methods. Earlier, we saw that High highlights the role of fecal transplant as a treatment method in *Fecal Matters*. Nevertheless, this method has not gained full scientific status.

¹⁴⁷ Personal communication with the artist.

The fact that this method remains at experimental level shows that the related medical practices have not reach full level of institutionalization. The process, which starts with the production of scientific knowledge, continues with the development of treatment methods and their systematization and ends with the development of related products and services in the pharmaceutical industry or medical fields is interrupted. For example, under what conditions the samples taken for fecal transplant need to be stored, according to which criteria should the transplant patients be selected, how often should this application be realized, and the possible side effects or benefits, etc. have not been fully clarified. Based on this uncertainty, High develops practices that deviate from the normative process and posits them as part of her art practice. Each project developed in this context exhibits t possibilities by developing various aspects of a promissory understanding of microbe.

High's speculative artwork—*The Bank of Abject Objects* (TBAO) (2016) predicts a future where people might preserve their poop in proper conditions because this would be a rich source of value, not only for economic ends, but also well-being. As High puts it, “no one really knows the complete properties of poop as of yet, but I am banking on ‘healthy’ poop (whatever that actually means) becoming an important traded good in our bio-futures”¹⁴⁸. In this project, High plays with the classical conception of bank while reversing how the value is constituted. A bank is an institution which procures the storage, circulation, proliferation, reproduction, and even, diversification of objects determined as having value. It carries into “effect” the functions in question, regulates them, and creates new functions when they are needed. In this way, the work responds to a problem of equivalence. The ancient question of “how do we decide that three tables are equal to five chairs” is resolved by equivalently valued objects put into systemic functioning by the creation of an omnipresent entity: a monetary system (Aristotle, 1990). Thereby, in *TBAO*, things are (re)valorized, gain an exchange value and a certain margin of convertibility of its value according to social, political, or economic events and their implications with one another.

What is valorized in *TBAO* is the abject itself but with a paradoxical status. Although the “abject” has a conventional meaning defined as “extremely unpleasant and degrading”, it also has some characteristics which are worth storing, operating upon, or even sharing. The gut microbiome is considered as having valuable qualities to sell, exchange, and circulate. Through

¹⁴⁸ Personal communication with the artist.

these qualities, the work challenges the human notion of abject and the conceptualization of waste as defined through futility. Thanks to recent developments in microbiome studies, we know that the microbes regulate fat storage, make essential amino acids (protein building blocks), help us absorb iron among (other things) and help make gut cells (food absorbing and antibody producing).

TBAO, which refers to the self-proliferating capacity of microbiome, connects this capacity to the *sine qua non* of the capitalist economy that is the bank. ‘This thing will be used as a bank!’. ‘This shit is your investment for the future!’. The idea doesn’t only challenge the human notion of abject but also presupposes the inherent qualities of microbes in their networking in the gut microbiome. A microorganism living inside the human body evolutionarily found ways to cohabit within the human body by working via their hosts (Yong, 2016, p. 101). It is a process of co-development that changes both sides, human and bacteria (Yong). When the work suggests a do-it-yourself stool prototype, including honey as a natural preservative and its antimicrobial properties, it creates the conditions for the co-existence of certain interactions, cellular, chemical, or physical, and administers them within a conception of a “user-friendly” tool.

This brings about a deviation in terms of the circulation of value in capitalist economy. Stored feces have a value in terms of the microbial richness it contains, and this value increases itself. It can be activated in the suitable context and through this it can be linked to existing operating mechanisms of capitalism. Or, again, if suitable conditions are created, it can be exchanged with other users, creating a potential market, not necessarily a capitalist one, maybe, at least not yet. *TBAO* is an outline of a microbial economy. If it can be combined with other economies, it may not be completely excluded from the capitalist economy but *another kind of economy* may arise, not completely outside of capitalism but in its *pores*.

The *OkPoopid* (2017) project continues this same idea, this time through the question of alternative exchange pathways. If we do not know according to which criteria subjects should be selected for fecal transplant but they can be predicted based on the factors such as lifestyle, diet, and environmental conditions, then a platform can be created where these factors can be discussed among the users. *OkPoopid* is an application that serve as an interface that provides poop exchange data between users. Users who enter their fecal samples into the system learn which users they can match based on percentage. According to this projected percentage, they meet each other and talk about their lifestyles. From there, they intuitively try to decide whether a fecal transplant would

work between them. If they think that it is possible, then the exchange will take place based on the logic of gift. Therefore, the value resulting from the self-enrichment of microbes combines with the notion of gift, which appears as a social value in human culture. Microbial economy turns into a gift economy, bringing the power of microbiology to a problem of life beyond the context of disease.

Treatment of disease is no doubt important. However, the process from diagnosis to treatment has problematic sides at every stage, especially in the absence of fully stabilized institutional support columns. *TBAO*'s user-friendly structure interferes with the circulation mechanisms developed at the initiative of *OkPoopid*'s user groups. After the storage and circulation mechanisms, the last stage that will complete an economic cycle, which is "putting into use", in this context the alternative ways for treatment either in the personal or collective level, is left to existing devices of capitalist economy or agreement between users. Another project—*Bio Blanket*, will produce an alternative method for this and will realize it as an artistic performance.

It seems like from the very beginning High has been attentive to what sciences have to say about the Crohn's disease. In her projects, however, she operates at the limits of the science in order to penetrate into their unknown, unsaid, or unfelt, basically impinging on the social, political spheres. The incapability of sciences to capture those lines doesn't arise from insufficiency of techniques but from the sciences' very way of functioning. The mutual presuppositional relationships among (personal) physical discomfort (symptoms), the determination of pathologies (disease), and proposed solutions (treatment) both signify the conditions of possibility of medicine and give a dynamism to it, which will permanently and sufficiently sustain it (Canguillhem, 1966). Thanks to the gained and imposed superiority of medicine over other pretender fields (Stengers, 2002) emerging from medicine's ability to put an efficient causality into practice, medicine acquires a normative framework (final cause). The appearance of each symptom, an untreatable disease, and new phenomenon (re)weaves and actualizes the relationships between science, technology, and medicine and establishes a complicated web of interrelated relationships.

The uncertainty arising from the incompleteness of the diagnosis and treatment methods in Crohn's disease enables the introduction of alternative methods to medical discourse and practices as in other similar cases. Rather than simply proceeding in by assuming the dichotomy between scientific and unscientific, *Bio Blanket* carries the tension between the two into the gallery setting.

The proposition that Crohn's disease is caused by missing microbes, combined with the suggestion that probiotics can be effective for treatment turns into an experimental performance. In dermal transfer therapy, the abdomen is covered with growth bacterial cultures. What kind of bacteria is used is determined according to those that appear to be missing in High's gut profile and are produced according to samples taken from "healthy" people with these determined species. These samples are expected to pass through the skin and reach the gut and affect the fauna in a way to complement the missing bacteria. This therapy needs to be repeated to be effective.

In *Bio Blanket*, a state of disease is transported to the public sphere as collective performance. What produces the problem is the solution itself (disease-causing-microbes/healing-microbes). But what is essential is not only to share alternative treatment methods with other people who are not directly involved in this disease but also to exhibit the microbial sensibilities in the projects presented under the general title of *You Are My Future*, beyond the systematic structure of scientific knowledge and the institutionalized practices of medicine.

The situation that we call the paradox of abject is resolved by the performance of a complex of values in accordance with the requirements of each project. The paradox thus expresses not a logical impasse or an intellectual design but the emergence of a productive moment of positioning of microbes in the context of disease in the surface of a larger social complex that produces it. Value appears as what deviates from the trajectory of principal realizations posed by the prescriptive devices embedded in social formations.

At the Edge of Death, Towards Life, And Its Beyond

The paradox, as the knotting point of possible deviations from the already-known, is what forces its own resolutions to be improvised in a wide variety of contexts. However, the nature of paradox is that infinitely multiplies itself in different situations and hits at some point its own impasse. This is even more obvious in the context of microbes and the diseases they are implicated in. There is only one dilemma to which the abject paradox and other kinds of paradoxes established in this context will eventually arrive: the most fundamental, constitutive, and absolute horizon of

experience and unthinkability in which all paradoxes emerge: death. With the last two examples, I will return to the founding gesture of our ecological examination of microbe-artworks at the very beginning of this study. I present the ethical problem as an exhibition of the duality of life and death.

* * *

In *Burial Garden* (2015), High designs the gravesite where she will be buried after she dies. Her plan is to have the gravesite and graveyard's head marker covered by various types of plants. But this must happen naturally and the plants should grow in accordance with the structure of the land where they are planted. This poses a particular difficulty since High selects plants according to their ironic and poetic names in Latin. The experiments should be carried out on how to grow the plants, to understand how they interact with the microorganisms in the soil (for example, High places the corpses of animals her cat has caught in the terrain so that when the bodies dissolve and mix with the soil, they make an impact on the development of the plants). As a result, all these elements come together in such a way that they represent certain aspects of High's life: coy, innocent, intuitive, and jaded, and more to come¹⁴⁹.

At first glance, the design of such a garden may suggest creating a landscape as an authorial artistic gesture. Everything seems to be the fictionalization of what the body will be after the artist's death and the meanings the gravesite will take in the human world. But this gesture hits at a very basic problem and opens up other dimensions and as many gestures. A personal death, how we understand it, and what we project will happen after the death turns into a unique problem. Designing a burial garden for a personal death instantly creates some uncertainty in the anticipation of the future. Factors such as determining the names of the plants that will cover the garden and their characteristics and knowing under what conditions they can flourish, the structure of the soil, climate, microorganisms that affect bodies, and the interactions between plants, animals, and microorganisms. They open up a realm of uncertainty altogether.

The question of "what will happen to my body when I die" becomes the question of 'how *one* dies'. This is immediately accompanied by other questions and death itself turns into a problematic field that goes beyond any personal investment and preference. Under what conditions

¹⁴⁹ <https://www.youaremyfuture.com/burial-garden>. Accessed 1 February, 2021.

does one die and with which elements, how many, how do they come together, where...? A personal death, by hitting the problem of the impersonal death, expands into the multi-dimensional structure of a problematic field. Beyond being the negation or opposite of life, death appears as a special problem (Deleuze, 1968). It is not simply a personal death expanding into the problematic of death. Either directly related to death or not, there is an affinity, a resonance between the problem of death and the structure of the problematic itself. Because the fact that death comes from the outside, that it is necessarily something that cannot be experienced, carries it into a horizon of unthinkability: the impossibility where life and experience cross themselves. This is what it means to think. Not the entries and exits registered in the land registry cadastral chamber of *cogito*'s safe ports whose boundaries are determined by presuming the substance of thought but everything that shatters it; smuggled goods, stowaways in the cruise ships, uninvited boats and unexpected storms, and the thousands of minor incidents that reassign the borders of the port with every drop of water beating the coast (perhaps one day it will have entailed the construction of a new port and brought forth a new cadastral regime).

Paradoxically, the manifestation of death as the horizon of the unthinkable is what carries it productively to the very tissue of events. It is not simply a reflexive attitude (even if compelling) but the excavation of an interval that singularly anonymizes events in the thinking of the unthinkable, the awareness of life living irreducibly:

It is at this mobile and precise point, where all events gather together in one that transmutation happens: this is the point at which death turns against death; where dying is the negation of death, and the impersonality of dying no longer indicates only the moment when I disappear outside of myself, but rather the moment when death loses itself in itself, and also the figure which the most singular life takes on in order to substitute itself for me, (Deleuze 1990, p. 153).

One dies, just like it rains. Death, as it never comes, but always is just about to come, takes the form of the problematic. It introduces newness as something unknown and unknowable, undetermined and undetermining, yet determinable in the proper conditions of the destitution of the death itself as an act of intervalling, gapping, abyssing the ungrounded ground, but grounding itself in the very structure of a problematic field. As death is always about "to come", a problem is always about to come, giving rise to questions to be posed. Posed, not in the hypostasized box called mind but in the very texture of situations, not exhausted simply by possible solutions but

immanently unhinged by potential connections and relations driven by the resonations between the past (the uncontrollable emergence of the memory in *this* situation) and the future (the fall-out of anticipated outcomes as the promise of the unexpected).

All this to say that a problematic field is what induces new beginnings. The questions posed in it cease being the negative tools or oppositional figures for overcoming “obstacles” but the energizing nodal points of a creative venture into which one violently, and necessarily, involuntarily and selectively enters.

As a matter of fact, it is possible to feel the repercussions of *Burial Garden*, which started in 2015, in High’s subsequent projects, in the contextualization of Crohn’s disease, in the production of the microbial expressions, etc. What prevents *Burial Garden* from being a biographical monument, however, is that it incites a dynamic problematic field in the impersonalisation of death rather than by suggesting solutions. “Organisms devouring each other in a constant process of symbiosis, things eating things, exchanging, becoming”¹⁵⁰. The problem of death turns into a problem of earth in another project, *Nos Habebit Humus: The Earth Will Have Us*.

Nos Habebit Humus begins with a humble promise: to tape the dialogue with another artist—Oliver Kellhemmer about the idea of *Burial Garden*¹⁵¹. However, the conversation soon ceases to be an inter-subjective exchange and turns into a new experimental site where other dimensions are included in the project. They visit the gravesite and explore the environment. Kellhemmer’s fascination with how the ruined cityscape is absorbed by ruderal plants inserts his interests in the project as a separate plane. Abandoned buildings, old warehouses, and the city’s wastewater treatment plants provide the conditions for the flourishing of these plants as the slower transformers. In human culture, what has been thrown out, somehow shifted to the margin, now appears as the locus of the transformation. They are the fermentation basins where new beginnings will grow: “slow fertilizers”.

We can interfere the extreme terms of this process. They can be held as separate terms, giving themselves as hybridities: “feral and cultivated, indigenous and immigrant, built and

¹⁵⁰ <https://www.youaremyfuture.com/burial-garden>. Accessed in 1 February, 2021.

¹⁵¹ <https://www.youaremyfuture.com/nos-habebit-humus>. Accessed in 1 February, 2021.

unbuilt, primeval and ruderal”¹⁵². But the “living tissue” in which they are essentially immersed turns them into plants as transformers where they can no longer remain themselves: not such or such plant, but the “indefatigable process of plant-ness”. Each term polarized as hybrids contours a solution in an act. The birth of a chlorphylic temporality. The interweaved rhythms that devour other temporalities. Cycles of dying that are dissolved into and transmuted in the impersonal death participate in the living tissue of the earth. “Some” thing has to pass over because there is something to “come” so that something becomes. Actual passing away projects into a future where inactual and impersonal “subsumption” or rather subtraction taps into alteration: *Nos habebit humus*. The earth will have us. The earth does have us.

* * *

The paralysis and anguish of tactual death, despair, annoyance, and disgust of “abject architectures” thus tumble into joyful probing heads of a wanderer as “source of an incessant multiple adventure in a persisting question” (Deleuze, 1995, p. 112). As Kellhamer participates as a separate plane with all his interests in *Nos Habebit Humus* as a pathway to *Burial Garden* that participates in ramifying High’s coy and innocent, intuitive and jaded characteristics with paradoxical points as another plane, so the “echologist” participates in this trajectory in his own way. Injecting a dose of “microbially” in writing that attracted uncertain life of echologist into its orbit through the microbe adventure, but only to launch the echologist to other orbits with multiple potential participative ventures.

And so, the meaning of a microbe-ethics also becomes clear here. Replacing the normative set of judgments based on the classification of good and bad conducts with a complex of forces that performs its capabilities is only possible with a differential distribution of roles. Microbe-ethics is to participate in the microbial field with scientific activities, art practices, and in thinking and writing. None can judge the other. Microbe-artwork is the presentation of one or more problematic fields in which they test their interoperability and capabilities. Echology is the ethical venture that problematizes participation itself.

¹⁵² <https://www.youaremyfuture.com/nos-habebit-humus>. Accessed in 1 February, 2021.

1. Hearing the Inactual

We are never fully able to hear our own voices. Our inability to fully hear our own voices is a reflection of our never fully being aware of our relationship with the world. We are never fully aware of ourselves. We always seem as though thrown into a life whose origin is never known. Our voice, which is thrown into the world, gains meaning according to the clarity of the sound clusters assembled by the objects hitting a field and brings “me” back to myself. The tonality of the sounds possesses a clarity according to the intensity of this rebounding and announces the sound’s layers to the world.

But what is happening in-between; in that place where the self has just begun to disappear and not yet found itself; in the midst of that noisy monologue of the self with itself that accompanies every waking moment of conscious thinking? When I seal my ears, eyes, and lips and listen to, I retreat into the crowded silence of things. A borderland sucks me in; a borderland between waking and dreaming, thinking and unthinking, seeing and unseeing, hearing and unhearing, doing and undoing. Now, the sounds and voices are not-yet but almost recognizable. But that doesn’t make them lose any of their abundance.

At one moment, I feel like I have heard those sounds and voices before; they shade into memories; I feel like I’m watching a scene from my childhood. Then, other memory fragments mix together; flashing like lightning, they paint an entire listening-feeling field with the brightness of moments never experienced before. On a thin and fragile ground, they invite me into their space; but if I be too willing, too focused on them with conscious will, they withdraw their invitations. It is impossible to hold onto them for long. It is not me who gives ear to them but they that give themselves to my ear. Whenever all voluntary thought and listening cease, I float into a field in a scene of fascinating clarity. I hear the voice of a stuntman in my ears, as if I am the one speaking... Aunts returning from the market gossip around the corner; a street vendor’s yell interferes with all the other ambient sounds. There are murmurs of people that I have never seen in my life and probably will never see...

Other sounds, too... A birdsong, the movement of water, a rug sitting motionless on the ground... Spaces, objects, and landscapes. While listening to them, I become them. Their quasi-existence becomes one and same with their self-encompassing fragility. A great dissonance of incipient ideas stirring outlines the excitements. I could spend a lifetime exploring their unimaginable richness. I know that eventually everything will return to where it started, with an “I”.

Avant de redevenir l’homme, il est probable que j’existerai en tant que parc.

Conclusion: Inside Out Envelope—Uncharted Realms of Microbe- Artworks

The Journey of Echologist

Our engagements with microbes necessarily take place through scientific theories and practices that transform these engagements depending on the changes in scientific fields. Nevertheless, what constitutes a scientific activity in its quotidian practices or creative moments is the extra-effects that lie beyond existing scientific procedures. These extra-effects are plastic elements that provide the internal transformation of the sciences but also extend themselves to non-scientific fields of activity as attention-grabbing factors. Interest, when not considered as the perspectival anchoring of the already invested aspects of human culture in the person, operates in the direction of proliferation of departures, echoing towards the unseen, unheard, unfelt of other echoes. An echo, which is already heard as a multiplicity of echoes, designates a research path, not as something already instituted, but as something posed in a network of questions, that is—the ramifications of a problematic field as the echoing of echoes. This necessarily creates a deviation from usual standards. The consistency of an echo depends on the perseverance of this deviating movement, literally deviating: “turning aside the right way or course, a going wrong, error”.

The microbe itself is such an echo: a persistent, obstinate “coming out” unexpectedly. Therefore, considering microbes in negative terms as disease-causing entities has not been in vain. Forces of microbes en masse that appear in epidemics overwhelm social, political, and scientific structures in such a way that only the full coordination of these fields can bring them under relative control. Here, we can borrow Klossowski’s striking expression to describe them: “integral monstrosity” (2017, pp. 69-70). Monstrous, because even in the conditions of relative stability a split will crack the ground. Integral, because the cracking cannot be localized in a field of activity but appears as a result of multiple differentiations traversing all fields. “Microbes always have the last word” (Pasteur).

However, this relationship does not proceed in a dichotomic way in the form of destructive microbes, on the one hand and subjugating cultural investments, on the other. Like every encounter, the human-microbe encounter drives both parties into a process of variation, in which they cannot remain as they were. Here, artistic activity can appear as the effort of giving consistency to this process of mutual variation. The total destructivity of the integral monstrosity is differentiated, distributed into forms that are minimized in artistic activity; or inversely, art minorizes the highly organized connectivity of instituted forms so as to make the microbial forces under proper circumstances flourish. Integral monstrosity tends to become-earth, becoming-earth of microbes and humans that are swept together in an artistic gesture. This is not couched in the all-too knowing, confident designation of the all-too human but is composed *with* and *through* microbial elements, their observed and experimented effects, as the explosion of the microbial forces in the human. That gesture appears as a problem, at the limit of two planes and problematic fields, which itself might be designated as a separate problematic field in and for itself (echoing of echoes). The gesture performs the problematic field by resolving a paradoxical point as the ingression of microbially in human cultures.

At this point, there is no reason not to call this an “ethics”. Unlike morality, ethics manifests itself in the performance of itself. It is the way of an act’s performing its power according to its conditions of realization and by interweaving different modes of relationship. A gesture is an ethical act that opens a gap between two standardizing procedures, stuck at one point in their normative deployment as a result of their encounter. It calls for a levering so as to resonate in their beyond as the improvisation of a solution. Therefore, in the production of microbe-artworks, it is a necessity that the artists practice in the biological laboratory. Microbes’ modes of activity or “affects” can only be seen in the lab. This necessitates entering into a “complicity” with the sciences. The difference between complicity and collaboration in the traditional sense of “working together in a joint effort” is that complicity provokes participation while generating differential roles: “Something different will be done here that is not done by the sciences”.

As the sciences approach the qualitative limits of the microbial field, they do not only produce the momentum of their self-driving process, they also condition and sharpen the complicity in an echo that emits the possibilities of an open sociality. At this juncture, another complicity, a tendency that has historically sensitized itself to the sciences’ approach to qualitative

limits becomes part of the process of artistic production of microbiality in the operations of capitalism. Here, to do something different than the sciences is to channel the surplus-value emerging from the scientific field of activity to the profit-making mechanisms of capitalism through innovation and development of products and services. Therefore, the neoliberal capitalist field is sensitive to artistic enterprises in the microbial field, which sometimes finds its own market niche in the form of biodesign.

On the other hand, describing this process as a relation of complicity implies that each field has its own irreducible aspects. Artistic engagement with biological systems or entities abducts emerging value in two ways. Firstly, it distances itself from the production of norms of scientific activity now no longer primarily defined by. Artistic engagement approaches the qualitative limit of its field with its own self-driving power. The interval opened by an artistic gesture is not what becomes recognizable according to deviation from a standard but the intervaling gesture itself produces value as processual outcome. In Simondon's words, a value is "the capacity for amplifying transfer contained in the system of norm" (Simondon, 2005, p. 331, also quoted in Massumi, 2017a, p. 357). While morality is devoted to the reproduction of norms, developing the appropriate mechanisms in order to control their accuracy, ethics suspends judgment and composes relationships to operationalize situational uncertainty. Secondly, for this reason, positing a field of activity as irreducible to the neoliberal field, even if it is an accomplice of it, creates a much more complicated problem. Because, as Massumi shows, capitalism derives its real strength, not from the articulation between exchange-value and use-value (because it exists in other economic systems as well) but from the capture of surplus-value (Massumi, 2018, p. 27). Where a value irreducibly propels itself, the operations of capitalism are at work, at least in potential. But this reservation of "at least" makes the whole difference.

A potential is located in the intervals, just like artistic gesture. This requires that art should be comprehended not in a specialized field like the "domain" of art but with a term such as artfulness, in a way of spreading it to a whole field of life. On the other hand, the fields in which artistic enterprise appears as the domain might also be composed as milieux, situated in the pores of capitalism as described by Marx. Some impetus here gesturally offers sensibilities for a postcapitalist future. They are dispersed in the field in the form of germs that have not yet arrived

in their terminus in their unfolding but stretch themselves as sensibilities. If anything, they are often captured by capitalist apparatuses before maturing enough to be extended into action paths.

That said, isn't it deeply sad, as the saying goes, that human beings cannot think of the end of capitalism but can think of the end of life? It is. It is sad because the conditions in which we live bring with them another problem associated with capitalism but not entirely reducible to it: belief. If we believed that we could bring capitalism to its end, wouldn't we? Maybe not. Yet, that's not the only problem. We no longer believe in the world, as Deleuze has said. We do not believe in the world because we now believe that almost nothing will surprise us. Our momentary astonishments are either stuck in the sad thoughts that have already settled in the world or are flattened, quantified, and fade away into the soft comforts of hedonic investments before we can even afford to attempt to explore the joy that comes with our fascination.

Belief, however, in Deleuze's sense—immanent belief, is what keeps us alive despite everything (at least in potential). As Massumi defines it, belief is “being swept up by the world,” which “constitutes a lived belief in it”, “an immediate, coming, embodied, participatory belief” (Massumi, 2011, p. 33; 2017b, p. 107). Even the smallest act takes the share of belief defined by these terms. It takes its most intense form in our fascination. What amazes us about the situations of the world, its events and compositions, is what attracts us to its relational, inventive, relationally inventive openness.

The concept of microbe-artworks offered in this thesis is the continuation of a fascination that started with microbes in their various fields of activity, passed through these fields to, finally, arrive at the creation of a complex of values that offer a wide variety of orientations and directions, entries and exits. It is a call to participate with these values, to twist them, be transformed with them, as values themselves are amplificatory and participative processes. Participating in or belonging to a problematic field, going through it with other problems, other relational processes, an echologist is the figure of a wandering researcher of ambulant potentials. This is the outcome of this processual call, expressing the belief in the world through microbe-artworks with the echological conceptual tools and participation in their problematic fields. Therefore, the echologist is also an accomplice of this process. The echologist writes, not about, but with microbe-artworks in an echological mode of investigation as it can only be expressed in writing. Yet, the echologist believes that writing still has the power to surprise us.

The Ethics of Microbe-Artworks, an Ecological Writing

Ecological writing differentially participates in the problematic field of microbe-artworks. This problematic field, however, is already a multiplicity of a wide range of activities, each echoing its irreducible excess in its differential manner. What was described earlier as the arrival of the unexpected is the echoing of these modes in a problematic surface, which is itself amodal. For this reason, at this level and order of things, any attempt at safeguarding conformity by relying on pre-designated form, being an adaptive function or structural subordination, or the coupling between things and words, and their meanings, depending on a confident posture of the graspability of the changing states of the world by a form of immutability, is destined to fail.

On the contrary, the “-logy” of ecology undertakes the task of making the excessive dynamism of situations’ ways of exceeding categorizations the executor of a research program. This time, each activities’ particular style of exceeding themselves emerging from the trajectory of microbe-artworks echoes in a thought dis-ease as the founding act of the writing space. The violence that thinking imposes on itself as its founding gesture in response to the question of “what can thinking do?”, the imperative of thinking the unthinkable, arises from the force of the sign’s blow as the not-yet thought but to be thought of thinking in paradox. It is the collapse of any confident posture in designating starting and ending points for thinking, anticipating the trajectory of a sign. The sign is mortal, condemned to lose its intensity, and eventually, disappear. But this is not its last world; the sign always looks for ways to be resuscitated. It sweeps everything towards the limit of the unthinkable. This is also the only way for thinking of and with microbes, by immersing in the ungrounded ground where microbes actually come from. Yet, each actual coming-out is an inactual coming-with. For this reason, thinking looks for life-support units in order to elude its inability of thinking which might drag it to total destruction; the integral monstrosity of and in thinking. The paradox of life and death: transforming the mortality of the sign into “a” life problem by a life-affirming gesture in the creation of a question-problem complex. This is what makes an “encounter” mortally creative. Here, microbe-artworks as a problematic field express the points of resistance in regards to the vivacity of the mortal sign and their composition in the unfolding of ecological thinking.

In this respect, echological writing is not a search for truth but the expansion of an interval opened by the positivity of the mortal sign: a modest, partial death, an interval of being. The dimensions of the microbe-artworks are scouted in such a way that writing's capacity of anticipating crumbles thus opening a way for it to overcome itself. But this capacity of exceeding itself arising from collapse should be fully affirmed at once so that the scouted elements can act as landmarks that re-energize writing. This happens through establishing complicity, this time in the space of writing. As much as the complicity between sciences and art and their coming together in the problematic character of the hyphen in microbe-artwork expresses an exchange, a reciprocity, it also keeps a margin of infidelity in the interval. This is what makes complicity a complicity. Betrayal to the anticipated forms of the accomplices as the promise of potentials. Echological writing: writing as echoing the unforeseen, fore-seeing the inaudible as only thinkable in an amodal sweeping. It is not simply a violation of logic's boundaries or drifting the elements of writing into an absurd organization where all meaning implodes. Echological writing is composed of highly predictable strategies that presuppose meaningfulness from the outset (after all, doesn't meaninglessness arise from the negation of a given meaning?). The real stakes lie at its fusing into a problematic field, at becoming a fly on the wall so as to capture the vibrations. Writing must betray itself, too. For this, it should transform itself into a site of experimentation by using different approaches or methodologies, any kind of analytical tools, when necessary, in great prudence. This is where writing itself becomes problematic. Where the infectious flows and their style of propagating become a pure line. Becoming-imperceptible. *Rien n'a changé et pourtant tout a changé.*

In this vein, perhaps it would be more appropriate to describe the function of echological writing in terms of its ambulant character of sweeping rather than wandering. Echological writing is not only the traitor of dominant significations and established order of the world. At the same time, it sweeps both towards their beyond where they become unrecognizable. Finally, the function of echological thinking refers to the complicity in which echological writing finds its normative ground in the academic environment. Echological writing can perform its potentials only in the cracks of the institutional organization of the academic setting. It doesn't simply negate the academic ways of doing things nor reproduce them by other means. Rather, echological writing draws its actual tendencies out of the past towards the echoes of futurity in the present. As academic research brings into fore the instituted approaches and methodologies of its setting, the

echological approaches them to wrench something away from them so as to turn them into a creative thinking-writing, which can in turn still be apprehendable in academic terms. For this reason, its anticipated outcome is not transgression but failure, where it finds the peak of its powers. While one aspect goes towards the power of the unexpected, another aspect inevitably goes towards failure. Whenever a recognitive mismatching makes its weight felt, when it begins to organize the elements around its center of gravity, echological research transits towards the orbit of another echo. This is what gives an echo its continuity and discontinuity, fragility and consistency. To make the apparatus of the ephemeral and the movement towards beyond in writing. The writing builds in snowballing fashion with elements entering an echo's vortex as an echoing act. In this sense, it doesn't simply avoid being systematic, but vortexical elements come into such proximity that they systematically overspill the known strata of experience, betraying their forms and structures. This is how Bergson explains the power of fiction:

Une expérience systématiquement fausse, se dressant devant l'intelligence, pourra l'arrêter au moment où elle irait trop loin dans les conséquences qu'elle tire de l'expérience vraie.
(2008 [1932], p. 59)

The adventure of microbes has its first pulse in animalcules. With animalcules, microbiality begins to channel itself into the sciences, art, and thinking. But every channeling is interrupted by a retention of excessive microbial potential in consolidated forms and subordination of its donation to structural mechanisms and their signifying regimes. Animalcules, however, continue to work from within in any microbial discourse, action, thinking, affect, and perception. Echological writing mimics this "working from within" through the composition of microbe-artworks. This makes embracing its failure as its finality an ethical act. Instead of the confidence of the too-human, the immanent belief of the more-than-human. Instead of calculated distancing of presumably unbiased research, the calculating distances of echology as differential participation. Echological writing thus affirms failure as the highest power of its activity. Because only the things that are worth the risk of failure are worth thinking and researching. This is also how echology sustains itself: by designing projects that are worthy of their failure.

Echology as the science or art or writing of an ethics of animalcules.

The Future Claim of Echology

When a process of thinking—especially if it culminates in the proposition of a research program, terminates itself and extends itself to an outside, it is likely it will make a claim to a certain “right”. The claim of this thesis is modest: to be able to freely conduct research in academia, without the policing of disciplines, with an ethics of care and concern, open to the possibilities of unheard ways of studying things. Echological thinking-writing as a practice sees its future in the coming determination of the academic community. Its promise, or what it can do, would be to catalyze an interest(ing) towards collective experimentation, individually and collectively, by echoing each other. In this respect, I would like to conclude this thesis with a few project suggestions in which the echological proposition may be meaningful in different contexts.

Stuttering the Situations

Throughout the writing process of the thesis, hesitation was something I encountered often at different levels and contexts. After all, the decisions related to the writing of this thesis were not always straightforward and drove me to falter over and over again. On the other hand, this was a situation I encountered often while working with artists. In their process, like mine, there were always bifurcated paths and it was not often clear which one was better than the other. In addition, while making an archeology of the term microbe, I also came across the moments of hesitation through ramifications of research paths. As a result, hesitation is a state or instance that traverses many different levels, situations, affects, discourses, meanings, and structures. It is not mainly due to situational uncertainty or doubt. According to Simondon, it represents a moment at which future potentials are fermented and existing forms of relationality begin to transform. For Spinoza, it designates an instance of the *fluctatio anime*, the fluctuation of the mind, and it often prevents one from even accessing the available possibilities. Future research should study this underlying tension that establishes hesitation. Echological thinking sits right at these kinds of tensions. Although it is not yet clear in what context this will be, it should concern a situation that traverses from the most ordinary acts of daily life to the more decisive moments.

New Normal of the Common Sense

Another issue that I often found myself thinking about throughout the thesis was the notion of common sense. Common sense occupies a degraded position in classical Western philosophy compared to other forms of knowledge. Yet, it indicates the “true” path to be followed in order to reach good conduct. It generally operates in the direction of reproducing conformal forms of reality with a claim to objectivity and with conventional uses of language. But still, throughout the thesis, I had the opportunity to observe that common sense has a certain plasticity, both in parallel with the transformation of the sciences and in accordance with different political, social, and economic events. Epidemics, especially, are events in which more than one common sense is present at the same time as a result of the search for security. Therefore, I think the dynamic nature of common sense is an issue that needs to be studied. On this subject, during the writing stage of this thesis, Stengers’ book *Réactiver le sens commun* was published (2020). In this book, Stengers remarks that contemporary philosophy has the task of linking common sense to imagination, in an era where science plays the role of modern shepherding. She offers a solution to this situation through Whitehead’s philosophy. The Covid-19 pandemic, which is still happening at the time of writing these lines, may bring to attention a problem of common sense through the problematization of the term “new normal”. New normal refers to the reorganization of daily life practices, inter-human relations, the spaces of sociality or institutional functioning. Perhaps imagination is needed the most when it seems needed the least. Can the relationship between common sense and imagination be placed in an echological perspective in the case of the new normal of the Covid-19 pandemic?

Echoing the Disasters

In Chapter 2, the theme of disaster was another topic that arose through the case of epidemics. In the chapter, I examined the theme in terms of the possibility of aesthetic judgment from a Kantian perspective, and in accordance with the requirements of that chapter. Somewhere in my mind, the physicist René Thom, who conceived disasters as prolific events that give rise to the birth of new potentials, was always near. I could not, however, use this frame within the scope of the problems established in that chapter. In this respect, it would be interesting to move forward in the direction of researching the echoes between the expressions of disaster that appear in different situations in science, literature, and philosophy. The main area I would want to focus on is the moments of “catastrophe” in the life of literary figures and its repercussions in their work.

The two figures I suggest studying are Henri Michaux, who suffered from alcoholism and drug addiction for a long time and Ernst Jünger, a philosopher and literary figure who was badly injured in the First World War. The inevitability of the wound in Jünger and the transformation of the interval into pure lines in literature and painting in Michaux are recurring themes in their work. I consider these two situations—alcoholism and war, not as moments of personal trauma or the sublime as the supposed trigger of creativity but as the collapse of the layers of various social relationships that constitute a personological ego. How, then, can we track the traces of the relationship between creation and disaster in their work?

Memory of the Future

The term “memory of the future” takes place in Brett Story’s documentary *The Hottest August* (2019). Story asks ordinary people what their expectations are for the future. Memory of the future emphasizes the role of people’s vision in the present for the future in potentially shaping the future. This thesis was a proposal about the failure aspect of ecological research. Our past, in a way, consists of a pile of projects that we couldn’t realize for different reasons. This is a situation that I frequently encountered with many artists and scientists. This project proposes the study of unsuccessful science and art projects as an echo of the future. Inventorying the implicit ideas, meanings, attempts to create mechanisms, apparatuses, techniques, or programs in order to bring a specific project to life demonstrates the possibility of a future that was not realized in the past.

Politics in Turkey

I was quite hesitant to put this project suggestion here. First, I want to be clear that I feel fortunate to have been a part of the Communication Department at University of Montréal and to work with my supervisor Thierry Bardini. However, most often, when you come from the “other” world to North America to do a PhD, what is generally expected of you is to either study something related to your country or to stay within the limits of a completely technical issue. You are asked to speak nothing more than your country in the first case or your expertise in the second. Nevertheless, it must be possible to establish a relationship with your country of origin without being reduced to either position. Although an echology of microbe-artworks ends with an ethical

proposition, the relevancy of this project for politics is not clear, apart from the generic use of the term biopolitics. But I think some aspects of this proposal can be directly effective in a political context. In this sense, Turkey presents a laboratory for thinking of the nature of politics.

In 2013, a social movement similar to *Occupy* took place in Turkey. The masses mobilized in order to prevent the construction of a shopping mall in the place of a public park, *Gezi Parkı*. Unprecedented in terms of both its quantity and quality in Turkey's history, this movement brought together many different groups and turned the park into a site of collective experimentation. Eventually, the government of the time withdrew the project. On the other hand, the fact that the *Gezi Park* protests were not covered by a political program was often identified by scholars and political groups as its shortcoming. According to this reading, everything went bad in Turkey after the *Gezi Park* events. As in the other places in the world, Turkey got caught in a serious wave of authoritarianism. In Turkey, however, this authoritarianism turned out to be a regime change with the presidential referendum held in 2017. Thus, on the one side, there was a social movement whose effects presumably disappeared as soon as the event faded out, and on the other, an "absolute" political change took place that would transform all existing institutions. I propose exploring the nature of politics that concern the conditions of social/political change through this tension in the case of Turkey.

* * *

I feel a similar pressure to conclude that Foucault felt during his inaugural speech at the *Collège de France* in 1970. Rather than adopting a final discourse that meets the norms of an academic thesis, I prefer to settle into a perspective where you sound out the discourses that already inaudibly speak in you, without feeling obliged to account for an ego embedded in an institutional framework. Being aware of the already speaking nameless voices, you can only join in, indexing the infinite activities of the world through sciences, arts, literature, or popular culture. So, here is to running after a language that listens to the muttering of things, to giving ear to "rudimentary" projects already fermenting in the texture of things, and to trying to give them a consistency that will enable them to do what they can do. In the interstices, this has already lodged itself into the current project, awaiting to be signaled in an instant, in a moment of suspense. Finishing is a suspense to continue.

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