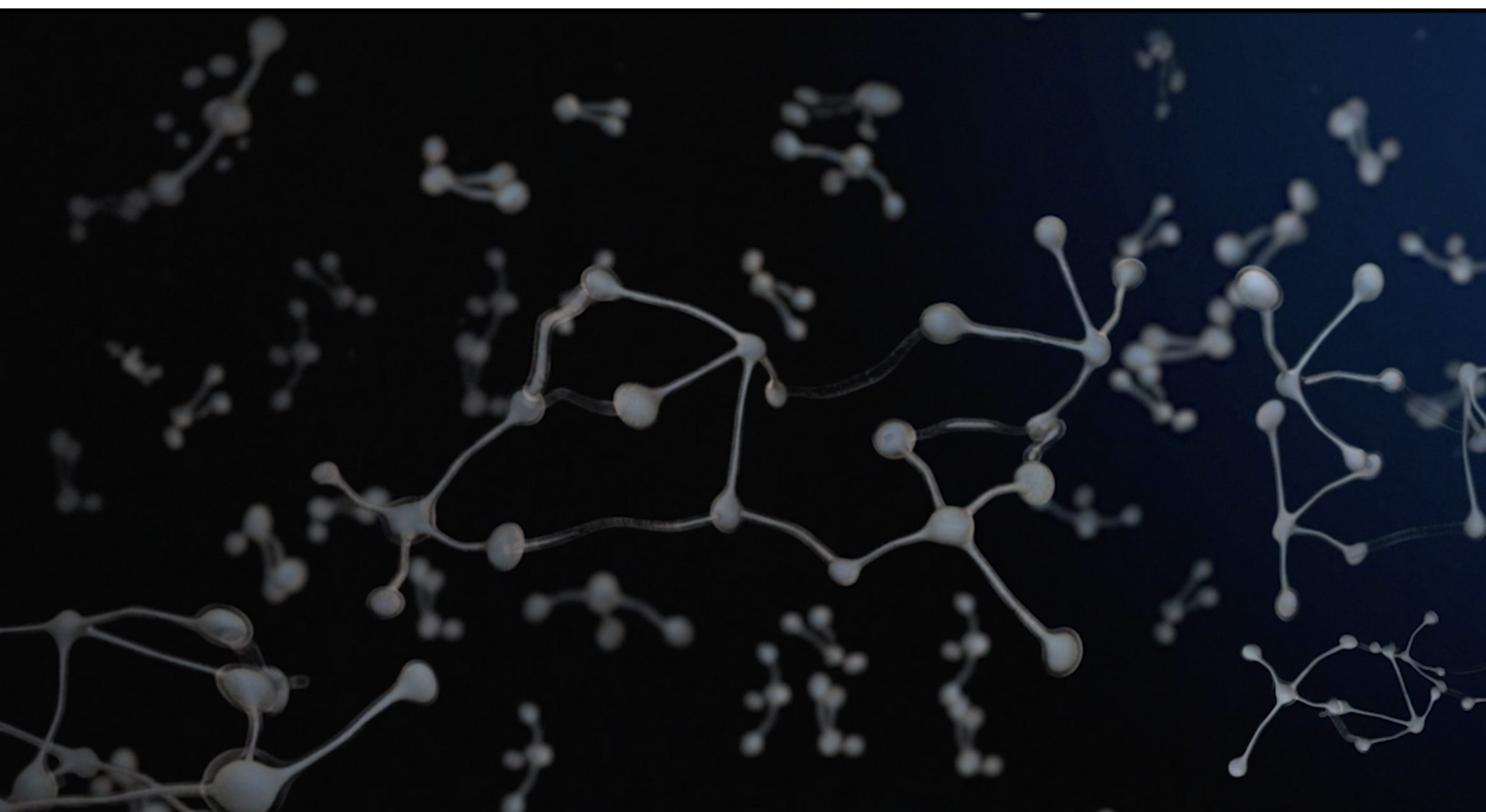# Game of Swarms

An artistic practice about networks

Paula Kaori Nishijima

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Acknowledgements

This thesis is precisely about the fact that 'we have never been one' and, here, I am *many*. This thesis is not a unique voice speaking from a single body. Rather, it is the entanglements of all the ideas, intentions, agreements and dissonances that compose this heterogeneous form of academic work.

I want to thank, first, my supervisor Prof.dr.ing. Robert Zwijnenberg for creating and expanding the connections of this research with me. His generosity and effort to make my propositions dive into the complex world of complications, questions and uncertainties was decisive to enjoy this exploration on networks. He guided me through a journey where the beauty is not in untying the knots, but in multiplying them in order to reach the extent of our memory and fortify the construction of our own narratives.

I am also profoundly grateful for the opportunity to attend the courses with Prof.dr. Kitty Zijlmans, who has always encouraged us to ferment critical thinking and give it a voice in our research. She has also opened space to us to expand the academic practice into new experimentations, that I had the pleasure of conducting together with my fellows.

Lastly, I could not have done any of this without the support of my family, which was my strength to overcome the most difficult times.

For Tommaso.

List of contents

INTRODUCTION

On August 19, 2019, a Winter afternoon in Sao Paulo, Brazil, 'the day became night'. The pictures of a heavy cloudy mass covering the sky proliferated on my social media alongside the comments on the reason why the *natural* light had been 'turned off'. Official press released notes with meteorologists scientifically asserting that the darkening phenomenon was caused 'by the sum of the arrival of a cold front in the east of the state, with heavy clouds, and winds that have brought particulate matter originating from fires in Paraguay and Bolivia'[1]—close to the borders with Brazil, but not enough *in* Brazil; on the other side, a multitude of Internet users loudly speculated about the apocalypse teaser and attributed it to the forest fires in Rondonia and Amazon area, that had their smoke blown towards the southwest city, blaming the earlier political decisions of president Jair Bolsonaro—who has loosed control over deforestation and given free passes to illegal logging, mining and farming.[2]

The present environmental crisis has put the public war between the Brazilian far-right president and whoever in the world is concerned about the environment in the international spotlight. Although Amazon is the Earth's greatest rainforest—being a vital provider of oxygen and carbon sequestration to the whole world—, Bolsonaro claims that 'the Amazon belongs to Brazil and European countries can mind their own business'[3]. The truculent tone seems to echoes the North American neighbours, for Donald Trump's withdrawal from the Paris Climate Accord, on June 1, 2017, anticipated by the president George H W Bush's declaration in the Rio de Janeiro Earth Summit, in 1992[4]. I have to agree with Bruno Latour when he says that Trump (and here I add the current president of my homeland, Jair Bolsonaro) managed to do what 'the

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[1] 'Cold Front and Wild Fires Cause São Paulo to Go Dark during The Day'. *Folha de S.Paulo (English version)*, August 20, 2019, accessed August 20, 2019. https://www1.folha.uol.com.br/internacional/en/scienceandhealth/2019/08/cold-front-and-wild-fires-cause-sao-paulo-to-go-dark-during-the-day.shtml.

[2] 'Deforestation of Brazilian Amazon surges to record high'. *The Guardian*. June 4, 2019, accessed August 20, 2019, https://www.theguardian.com/world/2019/jun/04/deforestation-of-brazilian-amazon-surges-to-record-high-bolsonaro.

[3] 'Bolsonaro declares "the Amazon is ours" and calls deforestation data "lies"'. *The Guardian*. July 19, 2019, accessed August 20, 2019, https://www.theguardian.com/world/2019/jul/19/jair-bolsonaro-brazil-amazon-rainforest-deforestation.

[4] Michael Wines, 'Bush and Rio; President Has an Uncomfortable New Role in Taking Hard Line at the Earth Summit'. *The New York Times*. Last modified June 11, 1992, accessed August 20, 2019, https://www.nytimes.com/1992/06/11/world/earth-summitbush-rio-president-has-uncomfortable-new-role-taking-hard-line-earth.html.

militancy of millions of ecologists, the warnings of thousands of scientists, the actions of hundreds of industrialists, even the efforts of Pope Francis' have not: opening wide to everyone that the climate question is at the heart of all geopolitical issues as well as directly related to questions of social injustice and inequality.[5]

The dispute for Amazon, which heralds just the top of a (melting) iceberg, involves more than the triune principle of nation, state and territory—or its relationship with the flowing power of economics—, as it concerns all the life-forms in the Earth. The daunting possibility of having neither a *common world* to share nor *a world* at all to live in the future translates the situation into terms of life and death—as it has always been—and all the fights that were supposedly to keep the *privilege* to something already *conquered* are dissolving in a unique war between the persistence of past modes of existence and the struggle to build up new more sustainable ones. 'The crisis', as Gramsci wrote, 'consists precisely in the fact that the old is dying and the new cannot be born; in this interregnum a great variety of morbid symptoms appear'[6]—and one of them is apparently the rise of zombie modern sovereignties, with refurbished social contracts, no doubt, and the label of 'populism'.

Indeed, the feeling of being always *in the middle* of a process with no clear solution to pursue and no path back to take is the most tangible and certain reality we have so far. The environmental crisis goes beyond matters of geographical belongingness and lands to fight for. There is now only *one* land to save, whereas we now see ourselves stuck in old dichotomies of Right/Left, North/South and climate change believers/deniers—whose polarisation reinforces the impossibility to grasp that we created orders to divide us, but we share the very same continuous soil of our single Earth.

Nevertheless, if the crisis is, indeed, planetary, who is taking control of such 'four-dimensional' creature, like the entire Earth? Will the European Union convince

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[5] Bruno Latour, *Down to Earth*: *Politics in the New Climatic Regime*, trans. Catherine Porter (Cambridge: Polity Press, 2018), chap. 2, Kindle.
[6] Zygmunt Bauman refers to Gramsci's association of the term 'interregnum' with the extraordinary situations in which the extant legal frame of social order loses its grip and can hold no longer, whereas a new frame is still being designed. Therefore, this interregnum may also refer to the framework of a current way of thinking, which is reflecting past modes of existence that no longer sustain the reality of our shared world.

the West and the East, the North and the South to change their fossil-based lifestyle? Or will the United States together with other friend nation-states continue planning for more progress and less mitigation of natural resources? In other words, if there is a locus of control in the planet, is it located in (global) sovereignties or spread across networked local agendas with global compromises? Alexander Galloway and Eugene Thacker pose a similar question on the prolegomenon of the book *The Exploit – A Theory of Networks,* in which the authors start a problematisation around a claim by the Dutch activist Geert Lovink:

> "Internet protocols are not ruling the world", Lovink pointed out, challenging our assumptions about the *forces of organization and control immanent to a wide variety of networks*, from biological networks to computer networks. Who is really running the world? "In the end, G. W. Bush is. Not Jon Postel," said Lovink, contrasting the American president with the longtime editor of the Internet network protocols.[7]

As a first impression, Lovink's statement that, in the end of the day, sovereignties matter more than networks makes sense today. Besides the cases of Trump and the Brexit, populist authoritarian-style governs that have been popping up across the globe—such as in Brazil, Italy, Hungary, Turkey, the Philippines and Poland—confirm that the sovereign state was never out of fashion. However, as Galloway and Thacker counter the argument, is it really true that networks are less important? And what kind of networks?

The oppositional construction of political discourse of sovereignties versus networks is a dichotomy that usually lapses into the idea that sovereignty is the contrary of network. One might think of the United Nations as antinomy to centralised powers, therefore, a global network. Nonetheless, because the conceptual structure of the U.N. is still based on the old framework of the right and legitimation of the sovereignty of individual states, it has to play a role of *supranational* centre in order to make this process of legitimation effective.[8] Hence, the proposal of a passage from international to global juridical structure is a transition that goes back and forth, and the ambivalence

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[7] Alexander Galloway and Eugene Thacker. *The Exploit – A Theory of Networks* (Minneapolis: University of Minnesota Press, 2007), 1. Emphasis added.
[8] Michael Hardt and Antonio Negri, *Empire* (Cambridge: Harvard University Press, 2000), 4-5.

of this movement illustrates how the notion of a body politic in networks is constantly renegotiated.

The same occurs with the (global) sovereignties of right-wing populists, whose protectionist regimes exploit the frustration of social cataclysm of neoliberal globalisation—the increase in unemployment, economic uncertainty and the migratory crisis[9]—, offering 'protection' to the classes that had felt, somehow, outside the net and the losses of the sovereign state; on the other hand, they, too, endorse the free trade of economic and financial elites and usually leverage the social media networks to reach out the masses, modulating thinking instead of disrupting the democratic frame by directly ruling.

It is clear thus that the network form has taken over the former structure of control—*modulating* its shape and the range of its expansion. The flag of nation-states exceptionalism used as prerogative to not comply with multilateral agreements or recognise *common interests*—such as the U.S. withdrawal from the Paris Accord or the Brazilian president's refusal in stopping the exploitation of Amazon—remains today in a limbo together with the old modern cast of bounded individuals. The hypothesis of having modern sovereignties amid the emergence of global dynamics seems to be a re-animation of an already exhausted body politic, which, in turn, does not recognise the exhaustion of the world's body. This situation translates as a conundrum to us, since the notions of territory and nation-state no longer sustain the reality of our shared planet. On the other hand, the more climate change, global warming and the environmental degradation haunt the Earth's inhabitants, the more it seems that we break apart the world as if boundaries of exclusion could prevent what is inside from perishing.

I became convinced that, in the core of this issue, dwell precisely our 'notions' and 'concepts'—enclosed in the huge monolith of Western modern thinking that, in its turn, is much more difficult to break. To confront the planetary crisis, one needs another way of thinking. Therefore, a new strategy to access these problems—that would not consist in simply applying a dialectical method of discussion, but something

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[9] Ronald F. Inglehart and Pippa Norris, 'Trump, Brexit, and the Rise of Populism: Economic Have-Nots and Cultural Backlash' (HKS Faculty Research Working Paper Series RWP16-026), August 2016, 11.

more like a multidimensional approach, capable of penetrating that Western bloc from all sides, whereby one's view does not change because a more logical option is offered, but because changing is the constitutive power of a *network approach*. This plan would seek anything but a final truth conceived by the reason. It would never end because the effect produced by the network traces the connections it entails and not the causes it might have. Isn't it what art does?

I made this question to myself when I was researching on networks to produce a work for an exhibition about climate change. Network and art are *names* that convey less than what they do and what they do is expressed by the relationship of form and content—where many of their contradictions reside. And it is exactly because the critical analysis of the network as a concept—whether mathematical, biological or informatic—uncovers so many gaps in the human reason that I chose it as a topic and methodology for my artistic practice. I used art to study networks, and the 'network thinking' to distribute the agency to all disciplines involved in this journey and, thus, acknowledge that climate change and environmental issues have everything to do with politics, technology, science(s), maths, ethology, aesthetics and, certainly, art. The importance of recognising this, for me, is the first step to a more sustainable thinking, one that have a multiplicity of viewpoints instead of different angles forced into a single belief. Let me explain how it happened.

Climate change, environmental issues, ecological awareness and so on have been contemplated as the main subjects of numerous exhibitions and art projects around the world in the last decades[10], bringing up utopias and dystopias about the relationship between humans and the environment. I made my own contribution for these narratives with an art project titled *Game of Swarms*, which was part of an exhibition at Mutant Institute of Environmental Narratives 2019, located within Matadero Madrid. The space is a two-year project to foster interdisciplinary artistic practices in connection with the challenges of the climate crisis.

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[10] For an account of these manifestations see Susanne Darabas, 'A Short History of Environmental Art' (Green Art Collection, 2014), Environment & Society Portal (Rachel Carson Center for Environment and Society) http://www.environmentandsociety.org/node/6806 and T. J Demos, 'The Politics of Sustainability: Contemporary Art and Ecology', in *Radical Nature: Art and Architecture for a Changing Planet 1969–2009*, ed. Francesco Manacorda (London: Barbican Art Gallery, 2009), 16–30.

As the name *swarm* may suggest, this is not a one-author project but, as most part of my works, it was produced with the collaboration of other parts, following one of the general lines of the Institute's project: co-operative resilience. It is the first time, however, that the social participatory practice comes as a *meta-process,* allowing me also to critically review this feature that has been a common ground in my works. *Game of Swarms* consisted of three phases: a research on social insects conducted with a team of ethologists; elaboration of a representative narrative of the theoretical framework to communicate the content of the research and, lastly, a performative work to engage various parts (e.g. audience, research team), in which through a series of encounters, collaborators were invited to reflect on the biological self-organised network model of swarms and left in charge to decide what rules should be set for the game within this framework.

In this thesis, I will give to the theoretical frame of that project a textual body. I want to demonstrate how an artistic investigation on networks and swarms can account for the contradictions of rational thinking and, accordingly, employ the network concept as an instrumentalization of the thought to undo the restrictiveness of our dialectical schemes of opposition. Although the chapters have a defined subject, it is the nonlinear coherence of both form and content of networks that conducts the whole orchestra. By doing this, I consider this ambiguous tautological discourse an ontological examination and, increasingly, an attempt to construct a new way of thinking.

I will do this by exploring the relationship between the network form and its content and how both aspects reflect in our political organisation. The first chapter is an aesthetical analysis of networks, in which I will introduce their mathematical roots that gave rise to their common visual representation as graphs and diagrams. By analysing the process of abstracting networks into nodes and edges, I want to underscore that the same way we divide actors from events, we detach individuals from their contexts. This thinking underlies our scientific and social constructions, which materialise into the matrix of visual references we use to express our relation to the world. In order to overcome this disjunctive anthropocentric motion, I will introduce the 'tentacular thinking' of Donna Haraway and the 'Vitruvian Frame' of Rosi Braidotti

as theoretical praxis that help us to construct new narratives and theories able to re-connect the individual with everything that had been left in the background.

In the second chapter, I will bring the investigation on networks to the engagement of the art field with the political context. I will do this through the analysis of Cildo Meireles' series *Insertions into Ideological Circuits* (1970-), which provides a multiplicity of readings about the shift from the art object to a socially engaged art with emphasis on the public participation. By doing this, I consider this motion experienced in the art field aligned with the emergence of social movements of the 1960s in great part of the Western world against centralised forms of powers (e.g. civil rights movement, the anti-Vietnam War movement, the women's feminist movement etc.), which expands the spectrum of our perception of networks to the social and political aspects entailed in their complex relational approach. Understanding from where the idea of the network as a resistance comes from is important to bring the discussion to our days and take stock of the changes in our political organisation. In the second part, I will discuss the case of Cambridge Analytica and its influence on the results of the U.S. elections 2016. This example exposes how current power centres leverage the network form in order to re-establish their immutable hierarchies and control stability, moving towards an isolation in space and disconnection from the reality of a shared world.

The third and last chapter comes with the art project *Game of Swarms*, which explores mainly the fact that the individuals of swarms work together without a locus of control, that is, they are self-organised. I bring this framework in my artistic practice to provoke the audience in relation to our current political structures and use the narrative of the game to imagine new forms of making politics and a new way to think our relation to the world.

Chapter 1

Network aesthetics: the dimension of multiplicity

Every time that I research on a topic, I have to elaborate visually on it. It is a kind of 'seeing to think' and 'thinking to see'. It is not that concepts are simply signs to me, but the way how we represent and then perceive them consolidates an 'aesthetics of thinking', meaning that imageries or metaphors are worth by what they express as our view of the world—and, accordingly, our identity and place within it. [11] Artists appropriate this aesthetics to highlight what is meaningful to us; they also criticise it to point out what is left out; and a third case is when the recreation of an aesthetics is required in order to declare its position *in relation* to the first two cases[12]—the situation in which I find myself with networks. Here is the issue: the fact that networks have become a sort of dominant form—they are perceived as the main architecture and visual model of the globalised world, the Internet, our political organisations, the global economy and also biological phenomena—does not mean that we have abandoned our notions of territory, layers, bounded individuals and any other thing that breaks the world apart. Hence, in this first chapter, I want to trace a path to recognise what is important in the current representation of networks, acknowledging what is neglected in it and, finally, propose a new aesthetics to them.

1.1. Breaking off: nodes and edges

The fundamental depiction of networks usually refers to graph theory[13], which is, I admit, a playful 'connect-the-dots' way to understand different kinds of networks. The mind puzzle that originated this representation, known as 'Königsberg bridge problem', was addressed in a short paper by the Swiss mathematician Leonhard Euler (1707–

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[11] It has to do with Jacques Rancière's notion of aesthetics as the 'distribution of the sensible', which I incorporate in my research as a sort of sensorial exercise through which we learn how to recognise the world within we live and, therefore, also the techniques whereby the world is communicated to us. See Jacques Rancière, *The Politics of Aesthetics –The Distribution of the Sensible*, trad. Gabriel Rockhill (New York: Continuum International Publishing Group, 2004), 7-45.

[12] Jacques Rancière defines artistic practices as '"ways of doing and making" that intervene in the general distribution of ways of doing and making as well as in the relationships they maintain to modes of being and forms of visibility.' Ibid., 13.

[13] Graph theory is the study of graphs, which are mathematical structures used to model pairwise relations between elements. A graph in this context is made up of nodes (also called vertices or points) which are connected by edges (also called links or lines).

1783) in 1736. Imagine a small isle surrounded on each side by the main city and with seven bridges across the river connecting them (fig. 1). To solve Königsberg problem, one should find a route around the city that requires crossing each bridge only once without backtracking. Although Euler proved that such a path was impossible with only seven bridges—until a new one was built in 1875—, his true insight was to replace each land mass with a node and the bridges with edges, conceptualising networks by abstracting them into individual units (dots or nodes) and actions (lines or edges), which enables the possibility of developing formulae to analyse quantitatively how the nodes interact to each other through the edges.[14]

Euler probably understood that his strange geometry would have some usage for urban planning, trade routes or even colonial expansion at that time, but he could not imagine that behind the simplification process whereby the graph is conceived, resides the key structure to understanding the architecture of complexity. What happens if you add or remove a link from the network? Just a few changes in the topology are enough to bring about a revolution, reveal hidden paths or connections and transform entirely a system.

With the numerous possibilities that were opened up with Euler's graph theory, many contributors worked to discover all that we have to know about ordered graphs. Until the mid-twentieth century, graph theory was aimed at learning and catalogue the properties of the various graphs.[15] This resulted in a greater enquiry as, in the last decades, different fields (physics, mathematics, computer science, biology etc.) have focused their efforts to study networks within an ontological frame, that is, considering the network as a general property of specific phenomena. Formally known as network science, this academic field explores, for instance, network properties in linking structures on the Internet, the spread of viruses, communication paths in terrorist networks and networks from a social perspective.[16]

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[14] Eugene Thacker, 'Networks, Swarms, Multitudes, Part One', *Ctheory*, May 18, 2004, accessed October 10, 2019, www.ctheory.net.

[15] Albert-László Barabási, *Linked - The New Science of Networks*, (Cambridge, Mass.: Perseus Publishing, 2002), 13.

[16] Thacker, 'Networks, Swarms and Multitudes – Part One'.

Such a variety of subjects using networks as a frame to explore the topic at hand makes more difficult to define what a network is. Latour offers some help remembering us that, 'Network is a concept, not a thing out there. It is a tool to help describe something, not what is being described.'[17] The author recognises that much confusion happens around the word *network,* as it has too many meanings today. Almost forty years ago, when the term 'actor-network'[18] was introduced by him and Michel Callon, neither the Internet nor the al-Qaida had struck yet. Networks were thus a novelty that came to contrast with global concepts, such as 'institutions', 'organisations', 'society', 'culture' etc., which were conceived, in the words of Latour, as 'surfaces, floods of causal transfers and real matters of fact.'[19] Nowadays, however, the shift in the *topology* has taken place, as networks are the rule and surfaces are the exception—thanks to the extension of information technologies and the increasing belief that everything is connected. Correspondingly, the way how we think should have changed as well, so instead of thinking in terms of bidimensional surfaces or three-dimensional spheres, one should think in terms of nodes, whose dimensions are equal to the number of connections they have.

Up to here, the theory makes sense, but representing networks with nodes and edges does not seem enough to multiply the extent of thinking to that of network. When I started my research, the simplification, diffusion and even a certain banality of the diagrams of dots and lines gave me the impression that networks are more a seductive aesthetics of distribution, the one that spatially signifies our globe as 'borders are not the limit', than a dense concept assisting the rise of complexity. For this reason, I felt compelled to seek in the rational core of this abstract geometry the breaches that would allow me to detect what has been lost in the translation of networks into nodes and edges. I could have skipped the Eulerian maths and gone directly to living networks, but it would prevent me from grasping better the graph conceptualisation through what it *omits*.

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[17] Bruno Latour, 'Network: a concept, not a thing out there', in *Networks,* ed. Lars Bang Larsen (Cambridge, Mass.: The MIT Press, 2014), 71.
[18] For an account of 'actor-network theory' see Bruno Latour, 'On Actor-Network Theory. A Few Clarifications, Plus More Than a Few Complications', *Philosophical Literary Journal Logos* 27 (2017): 173-197. DOI: 10.22394/0869-5377-2017-1-173-197.
[19] Latour, 'Network: a concept, not a thing out there', 71.

The relationship between representation and function portrays the way how we *organise* and operate the things of our complex world. Euler's graph, for instance, represents a spatial and ordered way of performing within its network; we see it as a structural description, a map of discrete elements that are placed in a certain manner in a static context. This necessarily entails breaking up the units from the connections, so to have a topographical distribution of nodes and edges, actors and events and so on—privileging space over time. The clear division between actor and action brings up the first conceptual impasse of depicting networks, which concerns to the long-standing concept of individuation. What is a unit and what is the aggregate?

Galloway and Thacker define the concept of individuation as the process by which an entity is delimited and identified as an individual. When it comes to networks, the discussion unfolds in two kinds of individuation: the macroidentification of the network as a cohesive whole—which is a paradox, since a primary characteristic of any network is its heterogeneity (otherwise it would be considered an integral whole)—and the individuation of its component parts.[20] The authors thus argue that there is a tension between these two processes, as the first individuation would require a totalisation of the network as a (greater) whole, while what defines it are precisely their parts.[21]

We understand, then, that there is a contradiction pertaining to the 'nature' of networks, as they are defined by both the specific and the generic. Nevertheless, the difficult here concerns purely to our thinking, for what makes us see this as a conflict is the pre-established assumption that it is the whole that individuates the node. This logic here is inverted, as every node always makes possible the existence of one or multiple coexisting aggregates.[22] Each cell of one's hand, for instance, contains the complete genetic code for her entire body. Although part of this code is inhibited, as each kind of cell is 'specialised' in a certain function, the whole is present in every cell.[23] Likewise, the technological architecture of blockchain emulates the same principle, as

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[20] Galloway and Thacker, *The Exploit - A Theory of Networks*, (Minneapolis: University of Minnesota Press, 2007), 59.
[21] Ibid.
[22] Ibid., 60.
[23] Edgar Morin, 'Complex Thinking for a Complex World: About Reductionism, Disjunction and Systemism', *Systema* 2, no. 1 (2014): 17.

every node within the network has the whole information about the entire system.[24] Therefore, individuation in networks is not about to produce 'subjects', but to individuate a node as a part of other networks. It is to consider the individual as attached to its collectives.

This incongruence poses a problem to a bigger 'entity', as classical science has been, indeed, having trouble understanding its 'objects' in isolating frames. We have seen the world through its constituents for decades through a process based on *disjunction* and *reduction*—not much different from Euler's graphs discrete process. This investigatory principle tells us to divide nature into more basic things and study each of them at every level of separation without regard for the *connection* between them.[25] In other words, forgetting what we call the context or the environment. The *logic* is that if you decipher the parts, you will master the whole. In order to carry out this assignment, humans have been exhaustively investigating life at molecular level, studying atoms and superstrings to comprehend the universe and searching for answers in their genetic roots. It seems that scientists have individuated all the tiniest pieces, the microscopic secrets, but now it is a harder task to fit them altogether again. This is because by running reductionism, we stumbled upon complexity.[26] Nature is not a rigidly ordered domain where every piece has its right place. It is more like a crazy jazz orchestra, whose instruments can be played in all the possible notes combinations, altogether and at the same time—naturally encompassed by the laws of *self-organisation*. How can one thus assume that by analysing the sax's melody it is possible to deduce the entire song?

Today, classical science, with all its enlightened precepts, does not seem as logical as it was when *alienating* the parts from their contexts. If, on one hand, the logic of reductionism facilitated our understanding and led us to several scientific discoveries—being the propulsion of scientific research in the twentieth century—, on the other hand, it has also limited our view to a movement of 'zoom in'—the same that

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[24] See Wikipedia contributors, 'Blockchain', *Wikipedia, The Free Encyclopedia*, https://en.wikipedia.org/w/index.php?title=Blockchain&oldid=916026107 (accessed September 21, 2019).
[25] Morin, 'Complex Thinking for a Complex World', 15.
[26] The sociologist Edgar Morin defines complexity as being 'a measure of diversity of parts within a system', which is the first important definition of complexity on the field of sciences; he also sustains that complexity reveals the limits of classical logic, as a system (or network) is, at the same time, both *more* and *less* than the sum of its parts.

we do when individuating something—and a focus on the singular, whose agency is reduced at the moment it is fenced off and deprived of *effecting* and *being effected* by the 'rest' coexisting with it. Now the question is obvious, but perhaps we took too long to ask: how can one analyse the importance of the context, the environment or whatever comes after or behind the individual if we have disregarded everything outside the individual frame?

The habit of dividing—therefore, reducing—all the things in order to grasp them is a matter of *organisation* (and thinking).[27] Similarly to this process, individuation (in its classical sense) detaches a part from the whole by distinguishing it from the generic. In graph theory, it results in the web composition with apparent division between nodes and edges, actors and actions and so on. It implies that the individuated units are merely parts of the system—just like traditional reductionism claims that we are simply individuals in society and ecosystems.[28] What is important to us is that the representation of networks as graphs is based on both ways of thinking, as the discreteness of the nodes implies the processes of individuation and reduction—just like all the Western conceptualisations about the world and ourselves.

When I refer to the relationship between representation and function is because what is at stake here is not much whether the illustration of networks as graphs corresponds to the reality, but rather how we organise concepts and perpetuate these views as a mode of existence. Nevertheless, what happens when these notions, once coupled with the ideals of development and progress, cannot go out of the box of reductionism? What happens when we are stuck in the polar restrictiveness of dichotomies derived from the enclosure of individuals defined without their contexts? Humans and nonhumans, nature and culture, object and subject and all the other pairings that delineate *our* relation to the world have become problematic in times of complexity (and environmental crisis)—in the same way that representing networks

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[27] Morin argues that, 'the paradigm of the classical science considered that explanation consists of reduction to order (laws, invariances, averages, etc.)', while from a systems perspective, organisation is poised between order and disorder. See Edgard Morin, 'The Concept of System and the Paradigm of Complexity', in *Context and Complexity – Cultivating Contextual Understanding,* ed. Magoroh Maruyama (New York: Springer-Verlag, 1992), 126–129.
[28] Morin, 'Complex Thinking for a Complex World – About Reductionism, Disjunction and Systemism,17.

with points and lines is equally limiting to what networks may convey. My next task thus was to find a new way to represent networks and, consequently, a new way to think them.

1.2. Thinking-with edges, connections and string figures

Can networks offer an alternative to the paradigms of Western thinking? As we saw earlier, they challenge it with their logical paradoxes. In networks, individuals cannot be disconnected from their contexts, for while not only the part is inside the whole, but the whole is also inside the part. We should, then, find another way of thinking to comprehend networks within the network frame.

Donna Haraway, in her book *Staying with the Trouble – Making Kin in the Chthulucene*, questions precisely what happens when the best biologies of the twentieth-first century cannot do their job with bounded individuals plus contexts, organisms plus environments, or genes plus whatever they need, as they no longer sustain the complexity of biological knowledge.[29] Haraway makes a critical fuss about our old Western understanding of the world that became unthinkable in both biological or social sciences by evoking what she calls a *tentacular thinking*, a way of bonding with many companion species and staying with the trouble:

> The tentacular ones tangle me in SF. Their many appendages make string figures; they entwine me in the poiesis—the making—of speculative fabulation, science fiction, science fact, speculative feminism, *soin de celle*, so far. The tentacular ones make attachments and detachments; they ake cuts and knots; they make a difference; they weave paths and consequences but not determinisms; they are both open and knotted in some ways and not others. SF is storytelling and fact telling; it is the patterning of possible worlds and possible times, material-semiotic worlds, gone, here, and yet to come.[30]

The tentacular came up to me as a much better web-like concept than the automatic connect-the-dots Eulerian model of graphs. Networks are 'de-abstracted' into many-legged and many-armed *string figures*, which, in turn, rapidly tangle us with their Science Fiction, Speculative Fabulation, Speculative Feminism, Science Fact and So Far. This is Haraway's SF framing motif, a theoretical trope to think-with companion species and not only-human narratives. I could even replace the word network with tentacular,

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[29] Donna Haraway, *Staying with the Trouble: Making Kin in the Chthulucene* (Durham: Duke University Press, 2016), 30.
[30] Ibid., 31.

as Haraway points out that *tentacle* comes from the Latin *tentaculum,* which means 'feeler', and *tentare* means 'to feel' and 'to try'.[31] Networks would be thus the traces of attempts rather than the rational sequence of cause-and-effect; they would weave potential paths instead of raising probabilities and their risks; and, finally, not much about a concept, networks would be our own sensorial structure, a collective of sensors that would make us able to conceive of nature, the environment or the biosphere as something part of us as much as culture—shifting the logic of 'we are part of nature' (but, first, we're cultural beings!) to 'everything is part of us'.

If in graph theory the agency is attributed to the active nodes while the carrying out of the action is attributed to the passive edges,[32] the tentacular is about relaying connections and *life lived along lines, not at points, not in spheres;* it attaches and detaches, it is becoming-with and thinking-with—which is in the middle, passes in-between the points or actors.[33] It is clear then that to think networks within the framework of tentacular is not about spatialise dynamic changes with static patterns of nodes and edges, but to entangle the possible stories, possible worlds and times of past, present and yet to come.[34] The additional notion of time in tentacular is crucial to differ it from the Eulerian model of networks. Although Euler's graph is important as a structure to think about networks, it gives us the impression that they are indeed a diagram of dots and lines, a snapshot of some kind of invisible reaction spurred by the conjunction of discrete elements. The tentacular, however, is a dynamic *multiverse* way of thinking. It is action and movement (tracing paths, changing directions and opening up possibilities); the process-based individuation of the parts—in which nodes are indiscernible and occupy a *metamorphic zone*, to borrow Latour's expression, instead of referring to a location or an object.

Time in tentacular is aligned with Henri Bergson's concept of 'duration'. Time-as-duration is the process of change, which he formulates as constitutive—while the

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[31] Ibid., 31.

[32] Galloway and Thacker, *The Exploit*, 33.

[33] It refers to what the philosophers Deleuze and Guattari say about the *line of becoming*, which 'passes *between* points, it comes through the middle, it runs perpendicular to the points first perceived, transversally to the localizable relation to distant or contiguous points.' See Gilles Deleuze and Félix Guattari. *A Thousand Plateaus: Capitalism and Schizophrenia*, trans. Brian Massumi (Minneapolis: University of Minnesota Press: 1987), 293.

[34] Haraway, *Staying with the Trouble*, 31.

Eulerian arrangement of space and time is derivative, that is, a mode of spatialization that we use to regulate the thought in a practical way.[35] More importantly, duration is not an effect of subjectivity, but an ontological reality. 'The more we study the nature of time', Bergson says, 'the more we shall comprehend that duration means invention, the creation of forms, the continual elaboration of the absolutely new.'[36] Likewise, the tentacular nets of SF and its storytelling, whether fictional or factual, unfurl through a sympoietic threading, felting, tangling and tracking, whose multiple local agencies with many interests at stake are always about to change, create or transform something and themselves.

The representative potential of the tentacular is, therefore, *narrative*. SF is storytelling, a tool to assure that networks are inscribed within the principle of perpetual inclusion, that is, that they can be reconfigured in new ways and at all scales.[37] Whatever the beginning or the end, stories can change (within themselves and through different gazes)—and the potentiality for transformation is what measures the dimension of the network: each narrative is a *multiplicity* of durations. Haraway stresses, through the companion of Jim Clifford, that, 'we need stories (and theories) that are just big enough to gather up the complexities and keep the edges open and greedy for surprising new and old connections.'[38] The scale of 'that big enough' is not a matter of quantitative arrangements or only about adding more nodes and edges. This is about networks as a multiplicity[39], their capacity for heterogeneous transformations and adaptations—which makes them *robust* and potentially *resilient*.

We have now achieved what is, for me, the 'aesthetics of networks': the multiplicity. The philosopher Jean-François Lyotard called 'unpresentable' the object of an idea, which cannot be relativized as it is the absolute.[40] In the same way, one cannot present multiplicity—which does not mean that networks cannot be represented, as

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[35] Thacker, 'Networks, Swarms, Multitudes – Part One'.
[36] Henri Bergson, *Creative Evolution* (New York: Dover Publications, ([1911] 1998), 27.
[37] G&T argue that networks are multiplicities not because they are constituted of numerous parts, but because they are organised around the principle of perpetual inclusion. See *The Exploit*, 60.
[38] Haraway, 'Anthropocene, Capitalocene, Plantationocene, Chthulucene: Making Kin', *Environmental Humanities*, *Environmental Humanities* 6 (May 2015): 160. https://doi.org/10.1215/22011919-3615934
[39] On multiplicity in Deleuze, see Jonathan Roffe, 'Multiplicity', in *The Deleuze Dictionary*, ed. Adrian Parr (Edinburgh: Edinburgh Univ. Press, 2007), 176-77.
[40] Jean-François Lyotard, *The Inhuman,* trans. Geoffrey Bennington and Rachel Bowlby (Stanford: Polity Press, 1991), 126.

graphs have accomplished this task for a long time. The multiplicity, however, precedes the rational gesture of drawing a form to the indeterminate; it comes before the reductive abstraction of diagrams dividing actors from their actions, which goes toward our ordinary thought or the aesthetics of our thinking. Although it is a tricky job to find the network aesthetics through what is invisible in the visual graph, the multiplicity arises from the unseen and from what is inconceivable by the way how we understand the world. How then is it possible to come back to the visual representation and address this aesthetics of multiplicity? How can we train our gaze to recognise the multiplicity of networks and, accordingly, design a new way of thinking—the one that challenges the paradigms of Western thinking and their reductionist narratives? In what follows, I want to respond to these questions while putting some light on the concept of multiplicity with the help of another author.

1.3. Disrupting the Vitruvian frame: a critical reading through multiplicity

Rosi Braidotti, in *The Posthuman*, converts the exceptionalism of what she calls 'the Vitruvian frame' into a story of multiplicity, or better speaking, a narrative that reveals, through its unfolding, the existence of a multiplicity. She starts from the beginning of everything: in the outset of *our* world's history there is He—the creation of God in His own image'; 'the measure of all things' in Protagoras' classical formulation of Man, later renewed in the Renaissance universal model of Leonardo da Vinci's Vitruvian Man (fig. 2).[41] This image, with a man's belly in its very centre, addresses the ideas of Humanism as a doctrine, combining the biological, discursive and moral development of human capabilities into an idea of teleologically ordained, rational progress.[42] The drawing literally circumvents human exceptionalism as a package of the high-humanistic beliefs (faith in the power of human reason and rationality), which was reaffirmed in the enlightened eighteenth- and nineteenth-centuries.

Braidotti uses the Vitruvian frame to tell the story in which the human is protagonist and performs a monolog built upon the Humanistic claim to universalism of European values or the so-called West. She points out that this Eurocentric paradigm

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[41] Rosi Braidotti, *The Posthuman* (Cambridge/Malden: Polity Press, 2013), 13.
[42] Ibid.

entails the dialectics of the *self* and the *other* as well as the binary of identity and otherness—both a cultural logic of universal Humanism.[43] The opposition between them, however, creates space only for the self, leaving the notion of 'difference' in the negative spot. More than this, the 'otherness' is considered the counterpart, an essential inferiority that is reduced to the 'less than human disposable bodies'—whether sexualised, racialised or naturalised others. This Humanistic bounded notion of what matters as human is decisive to understand from where, in this story, the multiplicity emerges:

> It turned out that this Man, far from being the canon of perfect proportions, spelling out a universalistic ideal that by now had reached the status of a natural law, was in fact a historical construct and as such contingent as to values and locations. Individualism is not an intrinsic part of 'human nature', as liberal thinkers are prone to believe, but rather a historically and culturally specific discursive formation, one which, moreover, is becoming increasingly problematic.[44]

Acknowledging that individualism is not an intrinsic part of the human is the crack on the ground of the Vitruvian frame to let arise the becoming-with—which is also thinking-with and the inclusion of a new possibility, the one of multiplicity. 'Instead of the enormous opposition between the one and the many', Deleuze says, 'there is only the variety of multiplicity—in other words, difference.'[45] The division between the self and the other is not erased in the visual representation of the Vitruvian frame, though. Instead, Braidotti keeps the delimiting circle and square to indicate a Humanistic ontology there, while she analyses the transformations brought about by the change on the central role of this image.

The first shift indicated by the author is the replacement of the Vitruvian Man with the 'New Vitruvian Woman' (fig. 3), an image created after the former that places a woman centre stage. Braidotti argues that Simone de Beauvoir's emancipatory feminism is built upon the Humanist principle of 'Woman is the measure of all things female', which means that to account for herself, a woman should take into consideration the situation of all the other women,[46] establishing a cross-border synthesis of the self and the other. This common grounding among women or, we could

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[43] Ibid., 15.
[44] Ibid., 23-24.
[45] Gilles Deleuze, *Difference and Repetition*, trans. Paul Patton (London: Athlone Press, 1994), 182.
[46] Braidotti, 21.

say, the networked women connected by the Vitruvian female frame resulted into the principle of sisterhood during the second feminist wave in the 1960s—a period in which, we will see in the second chapter, many networked social movements emerged to oppose centralised forms of powers.

This first slit in the Vitruvian frame gives way to a series of posthuman critical readings and post-anthropocentric approaches that function through the deterritorialization of the human-animal and human-environment interactions. The cartoons of *Leonardo da Vinci's Dog* and *Vitruvian Cat* (fig. 4 and 5), for instance, ironically displaces the dichotomy between humans and nonhuman animals: 'Can a cat or a dog be the measure of at least some, if not exactly all things?', provokes the author.[47] What is decisive for me in this displacement of anthropocentrism is not only how it drastically restructures the human-animal interaction—whose bonds now are based on the experience of sharing the same planet or environment—, but how it make us recognise that our world's view is built upon *our* relation to world and this is the only reason why humans are exceptional in this construction.

A more difficult reconfiguration of the post-anthropocentric approach is experienced through a geo-centred perspective. In times of climate change, environmental crisis and ecological sustainability, the negative notion of these mutations is transformed into productive force (or multiplicity power) when we ask: 'what would a geo-centred subject look like?'[48]. What happens when we try to figure out what would be the representation of not just a node but all the networks of the Earth?

To elaborate a figuration (or an aesthetics) to the planet without enveloping it as a globe, we must blow up the Vitruvian frame once and for all. What Hawaray's tentacular thinking and Braidotti's critical analysis brought to me is the possibility of doing this through narratives and critical theory, whereby the individual is introduced into the complex world and connected to a multiplicity of *others*, disengaging her/himself from the dominant vision of human exceptionalism. It is like to reach all the dimensions comprised in these networks, so a linear way of thinking could not but

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[47] Ibid., 71.
[48] Ibid., 81.

apprehend a formless geo-centred subject, whose politics is not based on dividing and delimiting movements.

Chapter 2

2. Network politics: asymmetry as resistance

As I described in the first chapter, the aesthetics of networks goes beyond their representation and can be converted into narratives that enable the transformative and creative forces, constitutive of networks, to be expressed and understood. In this chapter, I want to make a transition from this representative narrative to a political one. To do so, I will take a step back to contextualise the emergence of a systems approach[49] from the second half of the twentieth century and its bearing on the passage of an object-oriented practice to a social participative one in the visual arts. I will do this with an excursion to Cildo Meireles' series *Insertions into Ideological Circuits* (1970-), whose Brazilian narrative, though specific, introduces the historical political conflicts of networks as a resistance to power centres and the dominant ideology. This first step is important to understand that networks function as a resistance only when they are asymmetrical to the dominant power. In the second part, I will bring the discussion to our days and analyse what power centres became after the decentralisation of the previous political structures and how control has come into existence in the current societies of control, described by Gilles Deleuze.

2.1. From systems to circuits: networks fight power centres

In 1970, during the 'leaden years'[50] of dictatorship in Brazil, Cildo Meireles produced the series *Inserções em circuitos ideológicos* [Insertions into Ideological Circuits] (1970-ongoing) for the collective show *Information*.[51] Two works from this series were exhibited: the *Coca-Cola Project* (1969) (fig. 5) and the *Banknote Project* (1970) (fig. 6 and 7), both exploring the notion of circulation and exchange of information as potential resistance to the dominant ideology. For the *Coca-Cola Project*, Meireles screen-printed empty bottles of Coke with the message 'Yakees Go Home!' (right beneath the Coca-Cola's logo) followed by 'MARCA REG. DE FANTASIA' (Fantasy trademark) and, below

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[49] The use of the terms 'system' and 'circuit' here aims at keeping the language used at that period and since I am elaborating on an evolutive narrative of networks, I am considering systems and networks the same.

[50] The 'leaden years' (*anos de chumbo*) refers to the iron-fisted rule of General Emílio Garrastazu Médici's presidency from 1969 to 1974. It is considered the most oppressive period of the twenty-one-year military dictatorship (1964–1985) in Brazil.

[51] See Elena Shtromberg, *Art Systems in Brazil and the 1970s*, (Austin: University of Texas Press, 2016), 27-28.

it, the artist's proposition: '*Inserções em Circuitos Ideológicos*: *Projeto Coca-Cola*, Gravar nas garrafas opiniões críticas e devolvê-las à Circulação' [register information and critical opinions on the bottles and return them to circulation]. The *Banknote Project* functioned in a similar way with political critical statements—such as the counter-slogan 'Yankees Go Home!' and 'Eleições Diretas' [Direct votes, a plea for democratic elections]—being stamped onto U.S. one-dollar and Brazilian cruzeiro[52] bills, after which, they were reinserted into circulation.

On the artist's notes about this series, Meireles accounts for the shift in his work, that was no longer drawn on metaphorical representations of situations; rather, he was working with the real situation itself, so long as his work existed in terms of what it could spark off in the body of society.[53] This statement evokes Jack Burnham's seminal essay 'Systems Esthetics', published in 1968. Burnham declares that 'we are now in transition from an *object-oriented* to a *systems-oriented* culture', and that, 'art does not reside in material entities, but in relations between people and between people and the components of their environment'[54]. Such systems approach is in consonance with the *general systems theory*[55] proposed by the Austrian-born biologist Ludwig von Bertalanffy, whose claim is that living systems are 'open systems', meaning that they are constantly 'exchanging matter with its environment, presenting import and export, building-up and breaking-down of its material components.'[56] Von Bertalanffy worked on applications of the view of life as a network of intersecting relationships not only in biology but opened up ways to approach other fields from a systems perspective, like in cybernetics and the technological structures that were emerging in the mid-twentieth century (e.g. digital computers, electronic devices)[57]. Likewise, the art world also experienced and reverberated this systems perspective in artistic and critical practices.

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[52] The cruzeiro was the currency of Brazil from 1942 to 1986 (two distinct currencies) and again between 1990 and 1993. In 1994 it was replaced with the real.

[53] Extracts from artist's notes on *Insertions into Ideological Circuits* (1970) and an interview with Antonio Manuel (1975) from Paulo Herkenhoff, Gerardo Mosquera and Dan Cameron, eds., *Cildo Meireles* (London: Phaidon, 1999), 181.

[54] Jack Burnham, 'Systems Esthetics', *Artforum* 7, no 1 (September 1968): 30–35.

[55] Ludwig von Bertalanffy wrote the article *An Outline of General System Theory* in 1950 and published an expanded version of his work in a book in 1968.

[56] Ludwig von Bertalanffy, *General System Theory: Foundations, Development, Applications* (New York: George Braziller, 1968), 141.

[57] See ibid., 19-25.

In 1970, the same year of *Information* at MoMA, Burnham organised *Software – Information technology: its meaning for the art*, at the Jewish Museum, also in New York. The exhibition involved leading conceptual artists, such as Vito Acconci, Joseph Kosuth and Hans Haacke as well as pioneers of new media art, like Nam June Paik and Sonia Sheridan.[58] Both *Information* and *Software* were aligned with the movement away from the art object but emphasising distinct frameworks. While the curator of the former, Kynaston McShine, connected the shift from more traditional object-oriented practices to informational ones with the repressive political contexts in many countries at that time,[59] *Software*, on the other hand, echoed Burnham's systems aesthetics, addressing the transactional aspect of art by engaging the public with programmatic situations structured by artists. In Burnham's words, 'information processing technology influences our notions about creativity, perception, and the limits of art', which ascribes to the nascent of electronic devices and digital computers an instrumental role in redefining the entire area of aesthetic awareness.[60]

Meireles' *Insertions* series synthesises McShine and Burnham's perspectives, as the works engage with both political context and the reconfiguration of the art object. The artist stresses the necessity of 'volatising' the form and finishing with the cult of the object as his main preoccupation was the public, or better speaking, how to achieve a public in its original, generous notion of a large and indefinite number of people.[61] The artist argues that this definition had been replaced by the idea of consumer[62]— which established an economic condition to the access of art. It is noteworthy that the concept of *public*, for Cildo, is not restrained to an 'art audience', but it is inscribed within the context in which the artist lives—namely, the capitalist expansion through multinational companies endorsed by an authoritarian military govern—, resonating

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[58] See *Software - Information Technology: Its New Meaning for Art* (New York: Jewish Museum, 1970); exhibition catalogue.
[59] McShine explains in the exhibition catalogue: 'If you are an artist in Brazil, you know of at least one friend who is being tortured; if you are one in Argentina, you probably have had a neighbor who has been in jail for having long hair, or for not being "dressed" properly; (…) It may seem too inappropriate, if not absurd, to get up in the morning, walk into a room, and apply dabs of paint from a little tube to a square of canvas. What can you as a young artist do that seems relevant and meaningful?' In Shtromberg, 27.
[60] See Jack Burnham, 'Notes on Art and Information processing, in *Software - Information Technology: Its New Meaning for Art* (New York: Jewish Museum, 1970), 10-14, exhibition catalogue.
[61] Paulo Herkenhoff, Gerardo Mosquera, Dan Cameron, eds., *Cildo Meireles* (London: Phaidon, 1999), 181-182.
[62] The use of Coca-Cola bottles and banknotes is clearly connected with a critique of the US expansion and mass consumerism. See Shtromberg, 30.

the movement from the confinement of the object-oriented representation to the society's *circuits* as a medium:

> The *Insertions into Ideological Circuit*s arouse out of the need to create a system for the circulation and exchange of information that did not depend on any kind of *centralised control*. This would be a form of language, a system essentially opposed to the media of press, radio and television—typical examples of media that actually reach an enormous audience, but in the circulation systems of which there is always a degree of control and channelling of the information inserted. In other words, in those media the 'insertion' is performed by an elite that has access to the levels on which the system is developed: technological sophistication involving huge amounts of money and/or power.[63]

The emergence of *Insertions*, thus, posits the conflict between two asymmetrical *topologies*: the centralised control of mass media communication (what he calls 'elite') and what would be asymmetrically opposed to it: a system created through the intervention on *circuits* that naturally exist in society. What is at stake here, in effect, is Meireles' elaboration on the concept of a 'system for the circulation and exchange of information' as potentially against the centralised power. Interestingly, it is the homogenisation of a system that, at the same time, creates the means for its disruption. When the multiplicity disappears, any information distinct from the dominant ideology becomes radical.

To analyse the dynamics and mutations within these circuits, let us come back to the abstract spaces of the graphic representation of networks and think *topologically*. This approach compares the structures of organisation and control of different systems architectures. The centralised control of mass media and the *Insertions*, for instance, constitute an asymmetrical opposition, whose antagonism reflects the political conflict of those days. Galloway and Thacker identify two topologies about global political conflicts from the modern era up to our times: the first is what they call a 'politics of symmetry', exemplified by the clash between Allied and Axis powers and, later, between Soviets and Americans. In the second half of the twentieth century, this mode of political conflict was gradually replaced by the 'asymmetrical dispute' performed by the networked social movements of the 1960s—but also guerrilla movements and terrorism—against established power centres. The authors call attention to the fact that, 'In conventional warfare, a networked insurgency will fail every time; however, in unconventional warfare (suicide bombing, hostage taking,

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[63] Herkenhoff et al., 181. Emphasis added.

hijacking, etc.), the insurgent is able to gain some amount of influence.'[64] Therefore, the asymmetrical conflict is always rooted in the antagonism between the political structures, where the tactic is precisely leverage one topology at the expense of the other. What happens then when art appropriates these strategies to oppose power centres?

The art critic Paulo Herkenhoff, in his article *Labyrinthine Ghetto: The work of Cildo Meireles*, argues that *Insertions* may be compared, on a political level, to the strategies of guerrilla warfare of the Brazilian radical leader Carlos Marighella[65]: grassroots-level street actions in response to the web of repression. The urban guerrilla operations, known as 'network within the net', were street tactics to use the masses against the enemy in order to respond to the police network.[66] 'As a guerrilla tactic', Herkenhoff says, '*Insertions into Ideological Circuits* are models of symbolic action in significant social systems'.[67] *Insertions* thus sneak in the Coca-Cola bottles and banknotes' actual systems of circulation of information to enable the clandestine tactical manoeuvre of political resistance. Although the artist's subtle action contrasts to the more aggressive Marighella's urban guerrilla, Meireles' code-style of transmitting counterinformation undoubtedly put him at stake as much as the activists engaged in guerrilla strategies—conveying more radicalism to the artist's gesture than the 'symbolic action' described by Herkenhoff.

Nevertheless, as Elena Shtromberg points out, more important in the connection between *Insertions* and the guerrilla tactics is Marighellas' emphasis on the circulation of the political ideology of the movement in informational circuits.[68] In the introduction of his *Minimanual of the Urban Guerrilla* (1969), the revolutionary leader asserts that, 'Another important problem is not merely to read this minimanual here and now, but to circulate its contents. This circulation will be possible if those who agree

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[64] Galloway and Thacker, *The Exploit*, 14.
[65] Marighella was a radical revolutionary who founded the communist guerrilla group Ação Libertadora Nacional (ALN; National Liberation Alliance), known for its support of armed struggle. He had lived Carlos Marighella was a radical revolutionary that had lived under the military dictatorship of Getúlio Vargas (1930–1945) and fought in the resistance to the later regime, installed by the coup of 1964. He was shot and died in an ambush by military police in 1969. See Elio Gaspari, *A ditadura escancarada* (São Paulo: Companhia das Letras, 2002).
[66] Herkenhoff, et al., 'Labyrinthine Ghetto: The work of Cildo Meireles', in *Cildo Meireles*, 48.
[67] Ibid.
[68] Shtromberg, 31.

with its ideas make mimeographed copies or print it in a pamphlet.'[69] Besides an immediate resemblance between Meirele's messages printed on the bottles ('Record critical opinions... and return them to circulation') and stamped onto banknotes and Marighella's instructions to disseminate his ideological agenda, both call to actions propose the same structure to face the power centre: the construction of a net in which the agency is *distributed* among the parts.

Whereas a centralised topology figures a pyramidal hierarchy whose agency is concentrated into a single node, the resistance to it will be embodied in the fabric of a distributed network where the agency is constituted through the circulation of the information within the circuit. Such assertion translates into the public engagement in *Insertions*, as the existence of the artwork is enacted by the participation of the public. 'People are lines', Deleuze proposes.[70] Their agency does not manifest as nodes, but here they play both roles, the node and the edge merged, that thread and tangle together themselves, expressing their tentacular temporalities of past, present and future connections. From the moment the artist 'distributed' his agency to the public, the notion of authorship becomes anonymity and, by extension, a matter of control and property. 'When the object of art becomes a practice', Meireles says, 'it becomes something over which you can have no control or ownership.'[71]

Such 'participatory' aspect in Meireles' work is indeed what confers to the *Insertions* narrative an underground tone and, built upon it, an architecture of multiple resistances. The prioritisation of the public and the insistence on the circulation of the information outside the institution also gives way to the institutional critique imprinted in Meireles' artistic practice. The art critic Guilherme Wisnik claims that, 'Cildo makes a reversed readymade: instead of appropriating the industrial object to function in the place of the artwork, as Marcel Duchamp, he introduces the artistic action into the industrial universe through its own system of circulation, as a sort of mobile *graffiti*.'[72] The analogy of the use of messages as a

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[69] Quoted in ibid.
[70] Quoted in G&T, *The Exploit*, 35.
[71] Herkenhoff et al., 183.
[72] Guilherme Wisnik, 'Dentro do labirinto: Hélio Oiticica e o desafio do "público" no Brasil', *ARS* 15, no.30 (October 2017): 107, http://dx.doi.org/10.11606/issn.2178-0447.ars.2017.132781. Translated by the author.

graffiti connotes the idea of something that surfaces the outside of the institution or the normative social contract that rules a society.[73] It is, so to speak, a *counterprotocol*.

It is true, however, that this antithetical quality of *Insertions* was ironically 're-reversed' once the art institution (in this case, it was not *any* institution, but the MoMA) readily sucked in the Coca-Cola bottles and banknotes to its neutralising display. More insidiously is the fact that the artwork came into existence through the legitimation of the institution, as the artworks were first presented at *Information* exhibition,[74] and there is no precise data about the number of bottles or notes that later circulated at that time. Such ambiguity implied in the interpretation of the work is alleviated by the curator Felipe Scovino, who argues that the efficacy of *Insertions* proposition does not rely on the quantity of occurrences but on its enunciation and the experience of becoming feasible.[75] Isn't he, however, talking about a metaphorical aspect of the work—the one Cildo claimed to had taken away from his practice? Or a 'symbolic action', as Herkenhoff pointed out? Even though much of the critic on *Insertions* tends to consider Meireles' project as either utopian or frozen in its *potential* state, the artist, almost forty years later, stated a soberer position:

> *Inserções em Circuitos Ideológicos: Projeto Coca-Cola* was to take an individual thing, that is, take the personal scale and insert it in a more complex world. The work is an operation and not its objects. The creation of these works consists basically in the contradictions of the system, effective to this very day.[76]

An imperfect utopia. A resistance that might fail. A system with gaps. Networks are not metaphors, as long as their effects are concrete and reflect our paradoxical, complex reality. Likewise, the process-based artwork is not just a sign. *Insertions* cannot be summarised as either an allusion to Duchamp's readymade or an allegorical resistance to the military regime. Yet, it is both things. It is also the institutional critique that conveys the arbitrary value provided by the gallery frame—without which, *Insertions* would have little antagonism to superimpose itself and implode the art object into its participative circuit. 'When Cildo's works encounter the public sphere', Wisnik

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[73] Shtromberg, 28-30.

[74] Teresa Cristina J. S. C. Oliveira, 'Systems and Feedback: Cildo Meireles' *Insertions into Ideological Circuits,* 1970–ongoing', (PhD diss., University of Illinois at Urbana–Champaign, 2013), 7-8.

[75] Felipe Scovino, 'Tactics, Positions and Inventions', *Third Text* 21, no. 4 (2007): 440, https://doi.org/10.1080/09528820701433810

[76] Cildo Meireles, unpublished interview with Felipe Scovino, Rio de Janeiro, 03 April 2006. Quoted in Scovino.

observes, 'they usually deviate to an uncanny place, something solipsist, in which the production of affirmations is constantly annulled by some intern poison.'[77] This is the labyrinthine logic of networks: the one that weave together the certainties and contingencies of the world in an exercise of the memory as a fragmentary dissolution of all phenomena.

What is meaningful for me in *Insertions* is the narrative aspect that it sets in motion—the one that tells the story of how a system outlook was experienced in the art field from the 1970s and its influence on the shift in the form of art—from the object to the circuits; from the representation to the reality. Consequently, it also influenced the way how artistic practices, like in Meireles' work, confronted the oppressive political context at that time, deploying the network form as an opposition to the centralised topology of military dictatorship. More interestingly, the tautological character of *Insertions* exposed the flaws and ambivalences of any kind of system—whether political or the art system itself—, showing that the resistance to power centres through networks is equally subjected to those ambiguities, which, soon or later, results in the appropriation of the opposing strategy by the dominant power.

In the next part, I want to bring the analysis up to our days and take stock of the changes in the topology of the political conflicts: from the asymmetry between the centralised forms of the military dictatorship and the networked resistance to the emergence of a new symmetrical opposition of networks against networks.

2.2. Inside the Labyrinth: networks against networks

Although the network form had come into existence a long time ago, it has only become the rule as a dominant diagram of our society in the last decades. As we saw earlier, G&T identified two modes of global political conflicts: the symmetrical clash between power blocks, like Americans against Soviets; and, from the second half of the twentieth century, the rise of asymmetrical conflicts, such as networked social movements fighting centralised powers. Today, one can witnesses the return of the previous symmetrical topology. This time, however, there is no power centre on the stage, rather, what we see is the emergence of a fight of networks against networks. 'One must

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[77] Wisnik, 107. Translated by the author.

understand', argue G&T, 'how networks act politically, both as rogue swarms and as mainframe grids'.[78]

In the following years of *Insertions*, the creation of an alternative space for the circulation of information was not in the fictional realm of art, but a new kind of circuit was emerging from the rising up of institutional power of banks and new corporations, which in the mid-eighties were starting to link themselves together through computer systems.[79] These multiple informatic networks, or the new cyberspace, were invisible to people, but gave enormous new powers of control to these corporations—spreading out the news about a world run by the financial system.

This sort of control is analysed by Gilles Deleuze in his short essay *Postscript on The Societies of Control*[80] (1992). The author states that we have passed from the 'disciplinary societies' of modernity, earlier described by Michel Foucault, to the 'societies of control', that abide in the late twentieth century. This passage is characterised by the shift from disciplinary modes of production, governed by the laws of the 'environments of enclosure' (e.g. prisons, factories, school, hospitals and so on) to the 'ultra-rapid forms of free-floating control'—based on the logic of *modulation* rather than the moulding style of the former. In Deleuze's words: 'Enclosures are *moulds,* distinct castings, but controls are a *modulation,* like a self-deforming cast that will continuously change from one moment to the other'.[81] Thus, it is no longer a control with an administration in charge, explicitly and directly imposing its force on the individual; rather, it is like he or she now occupies the net where they are able to circulate, entangle and create, while following the logic of formless forces. In terms of labour conditions, *modulation* differs from the Taylorism and its strict codes and well-defined instructions in the fabric. Towards the 1980s, a new mode of control started to appear, called by the French sociologist Philippe Zarifian a 'control by modulation', which gave the workers some freedom to manage their time, displacement and great

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[78] Galloway and Thacker, *The Exploit,* 15.
[79] The documentary *HyperNormalisation* gives a good account on the building of a 'fake world' run by the financial system of corporations and kept stable by politicians. See Adam Curtis*, HyperNormalisation, (*London: BBC, 2016), documentary.
[80] Gilles Deleuze, 'Postscript on the Societies of Control', *October* 59 (1992): 3-7.
[81] Ibid., 4.

part of their actions—our already familiar workdays of flexible schedule or working from home.[82]

Another decisive turning point for societies becoming that of control is the new type of machinery that they come equipped with: computers. Computers do not only address a technological evolution, but they express the several mutations of capitalism. These changes dematerialised the capitalism of concentration from the nineteenth century—based on production and the property—and brought about a capitalism higher-order production, which instead of buying raw materials and sell the finished product, it sells the service and buy stocks.[83] Thus, the enclosure of the fabric has been transformed into the dispersive concept of corporation whose core is controlled by the logic of market operations—losing its human aspect to become something immaterial, coded and deformable.

It is precisely the nonhuman aspect that makes this kind of modulative control so difficult to grasp—just like the forms of network management. The social theorist Zygmunt Bauman claims that, 'Power has evaporated from the level of the nation-state into a politics-free "space of flows"'.[84] He borrows Manuel Castell's expression to indicate the transition from the bounded enclosure of nation-states to the free-floating space of network society. Nonetheless, this was not a conversion of moulding discipline to modulative control, as in Deleuze, but what he calls the 'divorce between power and politics'. For Bauman, the present-day planetary condition is one *out of control,* and what preceded this state was the progressive erosion of sovereignties derived from the emergence of globalisation. It is a question of institutional disparity, as the power that 'matters' (the same that modulates in control societies) has already turned global, whereas the politics supposed to regulate, organise and control it remained as local as before.[85] 'The planetary state of affairs', he affirms, 'is now buffeted by ad hoc assemblies of discordant powers unconstrained by political control due to the increasing powerlessness of the extant political institutions.'[86] He proposes to recognise this

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[82] Yuk Hui, 'Modulation After Control', *New Formations* 84 (October 2015): 75, 10.3898/NewF:84/85.04.2015.

[83] Deleuze, 'Postscript on Control Societies', 6.

[84] Zygmunt Bauman, 'Times of Interregnum', in *Former West – Art and the Contemporary after 1989*, eds. Maria Hlavajova and Simon Sheikh (Utrecht/London: BAK and MIT Press, 2016), 206.

[85] Ibid.

[86] Ibid.

predicament as a case of *interregnum*, referring to Antonio Gramsci's use of the term to define a situation in which 'the old is dying' and what follows it is not fully designed yet or is not strong enough to replace the older—to put it simple, we find ourselves in times of crisis.

Although Deleuze and Bauman diverge about *control*, they both agree that a dissolution of borders occurred, whether in regard to the spaces of enclosure or the boundaries of nation-states. If, for Bauman, it proclaims times of uncertainty—translated into the fear that looms over contemporary society—, Deleuze, in his turn, affirms that, 'there is no need to fear or hope, but only to look for new weapons.' The (new) weapon is connectivity. Messages from terrorists are spread out across the globe by media networks. The possibility of a terrorist attack covers the population with anxiety and fear as much as real bombs would do. What makes terror the greatest weapon of the era of distributed networks is the fact that this strategy can penetrate the power blocs with acute precision. And the West knows it. Uncertainty is indeed what causes fear, and this is precisely what powers learned to use to control today.

I can remember my father teaching me that big companies love periods of crisis, as they can fire everyone and hire new more economic employees even before the turnover shrinks. In other words, they leverage the negative perception of a critical situation in order to take over control and act at their convenience—a sort of 'neoliberal state of emergency'. Nobody expects ethics from capitalist corporations, though. What happens, however, when political forces decide to use this 'anonymous' form of control within the network to cause fear? What happens when it manipulates the course of *democratic* elections?

In March 2018, The Guardian published the news revealing that 50 million Facebook profiles had been harvested for Cambridge Analytica, the analytics firm that worked with Donald Trump's election team and the winning Brexit campaign.[87] The data collection was used to build a powerful software program in order to predict and influence voters on their choices at the ballot box, ending up as the biggest data breaches in history— putting to the question the ethics of the use of personal data by political powers in democratic processes. Christopher Wylie, former director of research

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[87] Carole Cadwalladr and Emma Graham-Harrison, 'Revealed: 50 million Facebook profiles harvested for Cambridge Analytica in major data breach', *The Guardian*, March 17, 2018, https://www.theguardian.com/news/2018/mar/17/cambridge-analytica-facebook-influence-us-election

at Cambridge Analytica and whistleblower affirmed, 'We exploited Facebook to harvest millions of people's profiles. And built models to exploit what we knew about them and target their inner demons.'[88] There is always someone or 'something' feeding us fear, but unlike a dictatorship from the 1970s, we do not know how or from where this fear is disseminating today.

Nevertheless, some people decided to dig deeper into this big data strategy used in the 2016 U.S. presidential elections. The documentary *The Great Hack*[89], released in 2019, shows the testimonials of individuals that were investigating on the case before the scandal broke out and also former employees of Cambridge Analytica that decided to disclose what happened in the backstage of the campaign. Everything consisted basically of an experiment: collecting people's personal and private information through Facebook profiles in order to form a model to accurately predict their personality and, consequently, their behaviour. The logic is: if you know how one behaves then you know how one votes. After that, the voters were targeted with political ads designed to work on their particular psychological makeup and fears.[90] According to Wylie, Steve Bannon, who was the chief executive of Donald Trump's presidential campaign and co-founder of the far-right Breitbar News[91], follows the idea that for changing fundamentally society, it is first necessary to break it. Once you make it into pieces, then it is possible to remould them into a vision of a new society.[92] The use of new technologies through old strategies. Deleuze envisioned this when picturing the societies of control: 'It may be that older methods, borrowed from the former societies of sovereignty, will return to the fore, but with the necessary modifications.'[93]

It is no longer a matter of ruling on death or life, but on subjectivities through a *modulation* within the network. This is our new 'political-voter surveillance'—just another eye in addition to the Webcams and spyware that compose our everydayness surveillance today. The power centres were dissolved into the fabric of distributed

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[88] Ibid.

[89] Jehane Noujaim and Karim Amer, *The Great Hack*, documentary (Los Gatos, CA: Netflix, 2019).

[90] Carole Cadwalladr, "I made Steve Bannon's psychological warfare tool': meet the data war whistleblower', *The Guardian,* March 18, 2018, https://www.theguardian.com/news/2018/mar/17/data-war-whistleblower-christopher-wylie-faceook-nix-bannon-trump

[91] *Breitbart News* is a right-wing news, opinion and commentary website, which Bannon described as 'the platform for the alt-right'.

[92] *The Great Hack.*

[93] Deleuze, *Postscript on the Societies of Control*, 7.

networks, but only to insist on a totalisation of the units—something that we have been watching as a resurgence of narratives of identity and exclusion of others (or the *otherness*) in the right-wing populist movements.[94] Ironic enough is the fact that the centralised form—that insists in becoming centralised again—has added its own *insertions* into the current network, but as a reverse counterinformation, the one that aims at restoring the homogenisation of the circuit and close, once and for all, the system.

The case of Cambridge Analytica demonstrates how new sovereignties, native to networks, understood how to exploit the *unhuman* elements of the network to control the *human* aspects. They bred their 'anti-network within the net'. Nonetheless, as we saw earlier, networks are ambivalent, so even if power performs control within the web, it is always changing, and the minimal local disruption might become a global blasting effect—we count on leaks and whistleblowers to play their role on it. However, it is not enough. It is necessary to create a new asymmetry to the newly 'defaced' networked powers. One that will not occupy the alternative space of Cildo's *Insertions*, but produce a new topology detached from the centralised and distributed forms. Would it be possible, though? How can we conceive of an asymmetry to networks that does not, in any aspect, recall the centralised form? These are the questions embedded in the practice of my art project *Game of Swarms*.

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[94] Hardt and Negri draw on Carl Schmitt's theory to define the defense or restoration of the unity of the people by the right-wing: 'Right-wing movements operate on the logic of a clash of civilizations defined primarily in terms of religion, race, or both. Such civilizational identity, Schmitt asserts, is the psychological and ontological basis for political interest and desire: "Down, inside, to the deepest and most instinctive stirrings of his emotions, and likewise, in the tiniest fibre of his brain, man stands in the reality of this belongingness of people and race." The primary political obligation, then, is to defend one's own kind against aliens.' See Michael Hardt and Antonio Negri, *Assembly* (New York: Oxford University Press), 49-50.

Chapter 3

Game of Swarms: looking for an asymmetry to networks

In the previous chapters, I have mainly investigated networks considering their inherent properties as spatialised, so to analyse their visual representation and their different topologies in political conflicts. From this perspective, networks are interpreted as static patterns and do not address the dynamic aspects constitutive to them, such as their capacity for transformation and adaptation to changing circumstances. These are arguably their most important characteristics for the topic I presented in the introduction—the present environmental crisis—which makes us finally turn to living networks. Nevertheless, we could not arrive here without taking stock of the way how we understand networks and how it no longer sustains the complexity of biological, scientific or political knowledges, which is the reason why I developed the work *Game of Swarms*. Swarm has different connotations—from computational studies to the concepts of 'masses' or the 'people'—, but I will focus on the biological model of networks they represent.

3.1. Swarms and art: neither global nor local

The concept of *swarm* stems mostly from biological studies, having its roots in the field of Ethology. Ethologists study animal behaviour, which consists of the observation on how living organisms interact. Most interestingly, the behaviour of an organism is seen as at the intersection of an individual, group and the environment, so the locale of agency is never clear-cut—as it is in the Eulerian graphs—, but it arises from the interactions between the individuals, within the group and in relation to the environment. [95] Because of this emphasis on the connections rather than on individuals, I chose the framework of swarms to embody the conceptualisations I proposed in the previous chapters, whether concerning the representation of networks—as a dynamic narrative with interactive units—or as expression of a mutation in the body politic—as living networks that perform without a locus of control.

      My interest in social insects came up with the research on the forces of organisation and control within living networks. The fact that ants and bees—in which I focused on—are capable of carrying out complex tasks (the collective decision-making

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[95] Thacker. 'Networks, Swarms and Multitudes, Part Two'.

in honeybees, the cooperative 'bridge building' and transportation of heavy loads by army ants etc.) without a central control ruling them challenges a whole political ontology of human beings. Although the language used to name, for instance, the 'queen bee' or the 'queen ant' holds on the remnants of sovereignty, inside their colony, no one is in charge or telling them what to do. In effect, no ant or bee has a global view of what has to be done, but they react to what they detect around them and to the interactions with other siblings nearby. These dynamics result in patterns of local interactions that have global effects—what we understand as collective behaviour.[96]

Switching from the invisible flux of informatic networks to the swarming dance of ants and bees was a decisive move to confront the present environmental crisis. Since, nowadays, the concept of network is mostly related to technological networks—and we build technology by the means of rational thinking—this additional dimension of *life* was required to the research. Not only because of its dynamic aspect—Internet is actively in motion as much as social insects—, but for what is still 'unthinkable' for humans: the possibility of systems operating without a program or planning but based on random connections that together seem to produce a global harmony. When I say 'unthinkable', it is not that we do not acknowledge or understand that collective behaviour composes a chain of life-form's phenomena—even if we tend to forget that the way how an individual responds to a certain situation is the outcome of the interactions of its cells, molecules and so forth all the way down.

Nonetheless, as the entomologist Deborah Gordon points out, the more philosophical questions concerning the way how we understand collective behaviour are still unsolved as they revolve around two possibilities equally wrong: the first ascribes to the individual's genes the role of 'programming' all his/her independent actions, which adds up to make the organism, tissues, or colony; the second hypothesis considers the existence of an entity at the level of the whole system, a sort of superorganism, that drives the relations among the individuals.[97] Both options bear the rational assumption that the *effect is already in the cause*, locating a control centre either for each individual or for the aggregate, responsible for curbing anything that disturbs the monotony of

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[96] See Deborah Gordon, 'Without Planning – the Evolution of Collective Behavior in Ant Colonies', in *Arts of Living on a Damaged Planet – Ghosts of the Anthropocene*, eds. Anna Tsing, Heather Swanson, Elaine Gan and Nils Bubandt (Minneapolis: University of Minnesota Press, 2017), 125-137.
[97] Ibid., 126.

scripted actions. We need, therefore, new stories and new language to describe collective behaviour as the entanglements of overlapping connections that create and transform our world without a central entity taking care of it.

To speak about it, I evoked the concept of *Gaia*[98] in Latour's work, which was a key framework to connect all the dots of my research. Latour draws on James Lovelock's and Lynn Margulis's *Gaia hypothesis*, whose claim is that the Earth behaves as a *self-regulating system*—meaning a series of nonlinear connections between individuals immersed in the collective forces of an ever-changing world. Gaia is described as a sort of *control system* for the Earth[99] that, just like swarms, operates without foresight, planning or *teleology* on the parts of the organisms, but embracing the mutations and ambiguities of its lively network. Latour explains that the evolution of humans and their technologies are changing this, and the Earth has now entered a new epoch: the Anthropocene—which basically officialises the human gesture of taking control over the Gaia's system.

The intrusion of Gaia into us comes with a question: if the planet is, indeed, self-regulating and so are social insects, swarms and everything that we loosely define as *nature*, why then humans cannot be self-organised? Perhaps the way how Aristotle defined the man as a 'political animal' was more a curse than an exceptional definition. In times that we are trying to reconfigure the relationship between humans and the 'rest', answering this question becomes even more complicated. In order to analyse this, I began from the critique to the Modern thinking shared by authors like Latour, Haraway and Braidotti. This led me to question the representation of networks for what it divides actors from their actions and reflects the (ir)rational logic of interpreting individuals disconnected from their contexts and environment. Modern thinking and the alleged Enlightened Science are based on this 'individualistic reason' that translates the complexity of relational life-forms into human bounded individuals—apparently emerged out of the 'state of nature'. From this ordering movement, what was supposed to be a multidimensional web of coexistent beings is converted into a vertical

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[98] See *Facing Gaia: Eight Lectures on the New Climatic Regime*, (Cambridge: Polity Press, 2017) and Lenton and Latour, 'Gaia 2.0 – Could humans add some level of self-awareness to Earth's self-regulation?' *Science* 361, no. 6407 (14 Sep 2018): 1066-1068. DOI: 10.1126/science.aau0427
[99] Latour, *Facing Gaia,* 132.

hierarchical order, where power is top-down managed and configured as a locus of control from where the rules and protocols of a society flow.

At this point, I should prevent the reader from misleading the role of swarms in this game. *Game of Swarms* does not consist of metaphors of social insects to be used in the 'human fields'—even if an entire genealogy can be written from the viewpoint posed by the 'swarm intelligence'[100]—, suggesting that politics is self-organised life or life is self-regulating politics. Even less my intention is to make any kind of 'libertarian discourse' about the distributed form of swarms as resistance in social movements or in the utopian systems of crypto currencies. What is then *Game of Swarms*?

First, let me explain the practical part. This is a collaborative game, so the first premise is that individuals work together to accomplish a common goal—this is how a network approach challenges the logic of evolution through competition. They use a board, a pair of dice and a set of pieces, which are the materialisation of the network as nodes and edges (fig. 9 and 10). Before playing, I present the main properties of networks and guide them through the research on social insects I described above. Since the theoretical research originates from the graphs, the project aims at driving the participants to make this 'tour' from the visual representation to the political aspects comprised in the narrative of swarms as living networks. Hence, in order to imply a topological analysis, we have two different kinds of nodes: master nodes and nodes. The asymmetry between them (master nodes concentrate more connections than standard nodes) denotes the human exceptionalism in a network as well as the existence of power centres. Participants will decide whether the network should work for eliminating master nodes or not.

The part of the *game* comes from a previous work in which I investigated the relation of network and play as two ontologising forces that materialise into systems and the 'magic circle' of Huizinga.[101] Play also performs in the side of multiplicity,

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[100] G&T summarise this genealogy: 'In philosophy, the relationship between humans and insects far predates such scientific studies: Aristotle, in calling the human being a "political animal," made a direct contrast to the insect; Hobbes stressed the human capacity to emerge out of the "state of nature" through the giving up of rights to a sovereign, a capacity lacking in insects; Marx acknowledged the capacity of insects to build but emphasized the human capacity for idealization as part of their "living labor"; and Bergson, expressing a poetic wonder at the ability of insects to self-organize, suggested that evolution was multilinear, with human beings excelling at "reason" and insects excelling at "intuition".' *Exploit*, 67.
[101] For play as ontologising force, see Miguel Sicart, 'Quixotean Play in the Age of Computation', *American Journal of Play*, 10, no. 3 (Spring 2018): 251-252.

creating narratives that unravel by relaying connections between players—whose moves are conducted by both strategy and chance. Since my artistic practice is mostly based on social participation, I decided to work with both concepts which resulted in a sort of experiment through sessions of workshop (fig. 11), where the audience is invited to play, but also to create the rules of the game—the real *common goal* of this activity.

Another shared property of play and networks are the rules and protocols, respectively. Both have similar functions, as they make sure that the connections, whether in play or in network, actually work. This is a simplistic definition, we know, but what is important here is the question that anticipated this objective of 'creating rules', which concerns the matters of intentionality and teleology in swarms. Why, for instance, does a swarm or a flock of birds form the pattern they form in the sky? If there is no central control, then how are the actions created, started or allocated? Although researchers usually go for natural selection or genetic determinism to explain teleology in self-organised systems,[102] Kant, in *Critique of Judgement* (1790), had already accounted for the necessity of using teleological principles in biological organisation, so to make it intelligible, in other words, *logic*.[103]

Indeed, players started the game having trouble with the lack of a clear purpose—but swarms actually do not have it. Even if they display an apparent global pattern, it does not mean that the swarm prioritises the group over the individual, that is, the parts are not subservient to the whole.[104] As we saw in the first chapter, the units and the aggregate exist simultaneously and because of each other. Of course, one might think that this is not true, as ants and bees work for the colony all the time. Otherwise, what are they doing there? Considering that the parts work for the aggregate is, nevertheless, to return to the hypothesis of either having some kind of central control or a superorganism at the level of the whole system commanding all the local actions. What we call rules or algorithms in collective behaviour are the combination of local interactions that generates the behaviour of the collective.[105] This changes the reference from the whole, as described above, to the local, as these mechanisms are carried out at

[102] Thacker, 'Networks, Swarms and Multitudes – Part two'.
[103] Stuart Kauffman, *The Origins of Order – Self-Organization and Selection in Evolution* (New York, Oxford: Oxford University Press, 1993), 7-8.
[104] Thacker, 'Networks, Swarms, Multitudes – Part two'.
[105] Gordon, 126.

the level of the individual and its relation to immediate neighbours—which essentially guides the forces of self-organisation.

Hence, the elaboration of the rules by the participants is also a way to challenge the game's necessity of having a final objective. They are left with the task of 'regulating' a system without a ruler and a clear goal, but using the *agency* of each node added to the board. This is our *response-ability*[106], as Haraway says, because if the rules are created at the local level, each of us has the power to make decisions and adapt to the transformations of our network. Acknowledging this power of individual decision-making is a fundamental step to reconfigure our relation to the world. As soon as one is freed from believing in the old saw of order and progress as the purpose of human existence, one can settle the rules according to her/his own ethics and values, recasting a subjectivity moulded by the modern thinking.

A common conclusion indicated by the players is that swarms do not exist in the dichotomy of global and local, but in a third different level. Yet, we cannot rationally understand what kind of level or space this third type is, but we can perceive it through our imaginative experience during the game. Theory usually provides some arguments, like the suggestion that this is the level of multiplicity, where no one can speak about the global without accounting for every connection entailed in it; or this is a space where self-organisation conveys a nonhuman organisation—where the conception of a purpose is just a memory of the overlapping connections that our rational thinking endeavours to trace a limit and give a form.

I have to me that contemporary art occupies this third level—which is, somehow, the asymmetry for both the centralised and distributed topologies I discussed in the second chapter. This is because art is not identified with a unique topology, but multiple ones, which, therefore, confers to it numerous resistances. This assumption is aligned with philosopher Peter Osborne's argument that, 'contemporary art is an art of the actuality of *contemporaneity*'. [107] By contemporaneity he means the current complex interconnected web of disjunctive temporalities forced together by institutional synchronizations of economic and political forms, loaded with myriad unsolved

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[106] Haraway, *Staying with the trouble,* 16.
[107] Peter Osborne, 'A Formalism as Wishful as It Was Dialectical', in *Former West – Art and the Contemporary after 1989*, eds. Maria Hlavajova and Simon Sheikh (Utrecht/London: BAK and MIT Press, 2016), 33-35. Emphasis added.

histories. The theorist assigns to art practices the role of connecting the aspects of those processes from multiple standpoints, so art can function as multidirectional, translational practices—or as a translational space itself.

This is the third level or space perceived by the players, which is located in between the global and the local. It is in the middle of these stationary notions that art can fully exercise its productive force. This is not accomplished by solving the social and political contradictions of the system, but rather by expressing them through its own constitutive contradictions—called by Theodor W. Adorno as the 'double-character' of art, as autonomy and social fact.[108] I want to suggest that the 'double' is actually 'multiple'; 'If power is complex, scattered and productive', Braidotti says, 'so must be our resistance to it'.

This hypothesis recalls the importance of Meireles' *Insertions* as an artwork of contemporaneity. Whereas its political character is necessarily coupled with the historical context of the 1970s, more importantly, it has placed the germ of our present necessity to rethinking the way how we understand systems or networks—including the art system itself. The resistance that *Insertions* connoted by the will of deposing the art object proved to be inconsistent, for what the action promoted by the artist was appropriated by the institution after all—as the MoMA proudly exhibited bottles and banknotes with the sentence 'Yakees go home!'. It is this paradox, the labyrinthine logic of *Insertions*, that makes the work opened to its future (the contemporaneity), a composition that we now structure through the appropriation of its past.[109]

Game of Swarms adheres to the dialog of Meireles' *Insertions* with our times, insofar as it attempts to expose the ambiguities and possible flaws of the system. It is the discomfort in trying to make sense of a model that is not logical for us that I deem to be the seeds of a new way of thinking. In the effort of imagining, creating and testing new rules collectively, players confront their personal experiences and logics with the possibility of constructing new narratives for our political structures and representations as well as a new 'reason' that enable the coexistence of all the networks.

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[108] Ibid.
[109] The art critics from the 1970s, such as Paulo Herkenhoff, stressed *Insertions*' political charge related to the dictatorship of its time as the main feature of Meireles' work, while contemporary art critics, such as Wisnik, translated his artistic practice into an artwork of contemporaneity, which essentially addresses the contradictions of a complex system.

Conclusion

I opened this thesis speaking about our present planetary-scale environmental crisis and the way how some current sovereignties insist on *alienating* themselves from the reality of our *shared* world. It is precisely the 'scale' of the facts that drives the discussion to matters beyond geographical belongingness, as, today, the land we should fight for is the entire Earth. Yet, we see ourselves in the conflict between the huge shadow of ecological mutations invading the political fore and the human politics that is still tracing the limits of individual interests—projected in the modern notion of territory, nation and state. The resurgence of authoritarian governs—reactionaries not only in their conservative aspects, but also because they *react* to their opposition by appropriating, usually in distorted forms, their discourses, strategies and even their established goals[110]—, echoes the anxiety to overcome a situation that we ourselves do not cease to perpetuate.

In this thesis, I aimed at demonstrating that the way how we approach this problem, which is the way how we *understand* it, no longer sustains the complexity of our times, for what all the human constructions are moulded by the same principles of human exceptionalism and self-centred individualism. I thus needed a different approach, one that would disclose the impossibility of detaching individuals from their contexts and apprehend the complexity and multiplicity of the narratives that compose our existence. The burnout of our common world is, therefore, a predicament that makes us rethink all that we have about the human, including what we have then considered our exceptional property—the enlightened human reason—and through which we constructed our cultural and theoretical representations, political narratives as well as social modes of identification.

I introduced networks as an instrumental concept to analyse, besides networks themselves, the power formations entailed in representational and political systems by way of an exercise of merging form and content. In the first chapter, we investigated the roots of the visual representation of networks, whose abstraction into nodes and edges led us to question the reductionist processes of divisions that the modern thinking has established as a method of analysis—whereby the individual is detached from her/his context and the hierarchy implied in the opposition of the self and the

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[110] Hardt and Negri, *Assembly*, 48.

other relies on. I wanted to present two theoretical concepts, the tentacular thinking of Haraway and the Vitruvian frame of Braidotti, as the means to make arise the real multiplicity alive within networks, which is possible through critical thinking and the creation of narratives to our systems of representation. This is the way how we conceive of a new aesthetics of networks.

In the second chapter, through the framing on the network form as a resistance to power centres, we analysed the contradictions intrinsic to control within networks. Meireles' *Insertions* was our starting point to consider the topological aspects of networks as reference to a political investigation of the global conflicts experienced from the twentieth century up to our times. Moreover, the artwork also anticipated the current space of our societies of control, insofar as the coexistence of a dominant ideology and the counterinformation of *Insertions* within the circuit illustrated the makeshift nature of power in networks. And it is the awareness of this elemental ambiguity of the system that creates the necessity to elaborate a new topology, another form of resistance to the dynamic structure of contemporary power.

It was through the construction of this path, analysing the network properties as spatialised and static that we moved to living networks. In the third chapter, I described the art project that I developed through this research, *Game of Swarms*, whose narrative revolves around the fact that swarms are self-regulating systems—embodying the reality of a network that functions without a central control and through the local interactions between individuals, the environment and the group. I tapped into the main philosophical contradictions referring to this biological model, that come to the table as disagreements between our rational thinking and the richness of complex biological behaviours. Thus, I tried to prepare the terrain for what *Game of Swarms* attempts to do: a revision of these theoretical formulations as a way to redistribute the agency to local agents, or the audience, in order to make them change stories and create their own narratives, and, more importantly, recognise the importance of doing this as a way to reinvent new ethical relations and values suited to the complexity of our times.

In such a way, this thesis is not about how to switch from a thinking to the other. Instead, it aims at multiplying the dimensions of our thought, obfuscating the logical reason that allows us to tell one linear story. We do not want only one grand narrative, but many other stories that tell other stories. This is not about how to organise, but

rather how to change, adapt and create. This is about Latour's Gaia cracking the ground of human evolution as it turns out to not be as stable as we thought it was; or the tentacular thinking of Donna Haraway ripping the membrane of our brain mass to be transformed into a nervous system, spreading its dendrites and axons out of one's body to the formless space of the network.

While, after this research, everything probably seems to be a network, networks are everything that our rational thinking cannot fully grasp. At the same time, it is also what is hidden in this ever-expanding concept that works as an absolute potentiality, disrupting our cognitive dissonance and enabling new stories about our relationship with the world—where nature and culture are not divided but together constitute the milieu in which we live. Hence, we should not assume that networks are in the opposite side of our rational thinking. Rather, the latter coexists with the networks of our ideas— just like restrictive power flows to enclose its productive side and the productive force, in its turn, acts to explode the restricting borders—conceiving our complex reality as multiple forces poised between order and chaos.

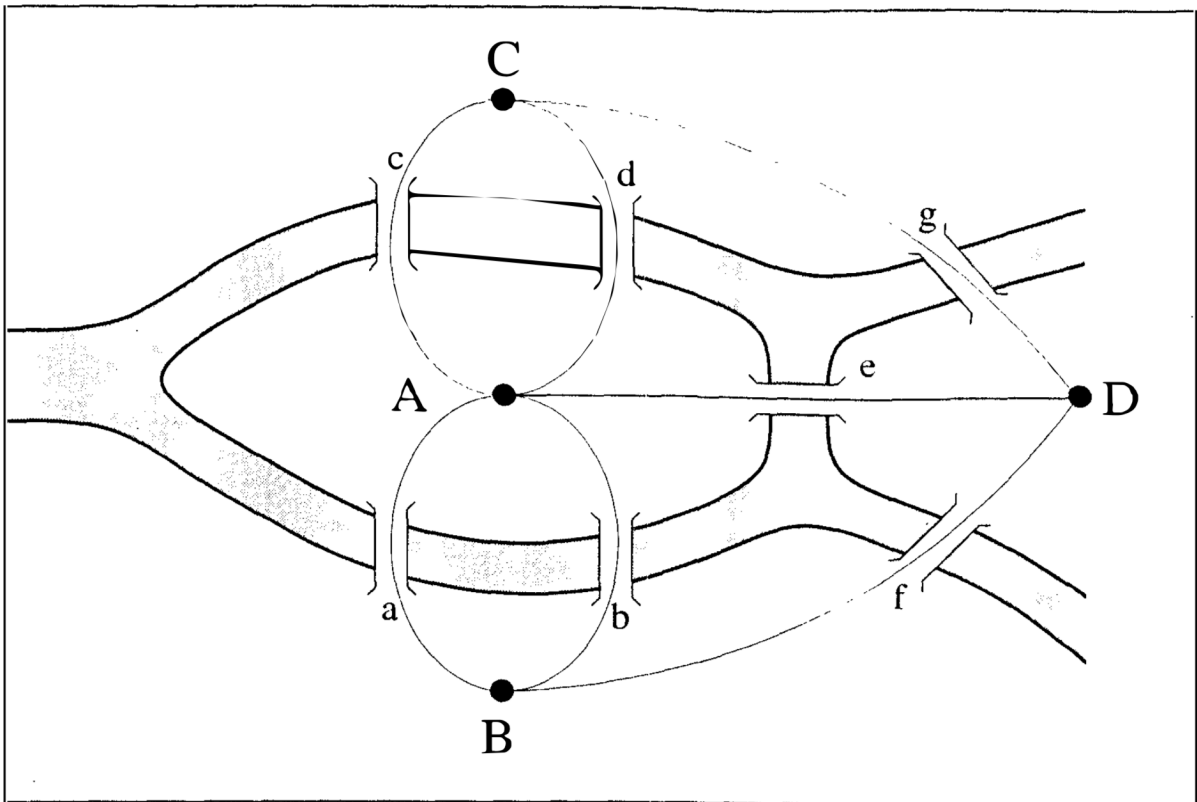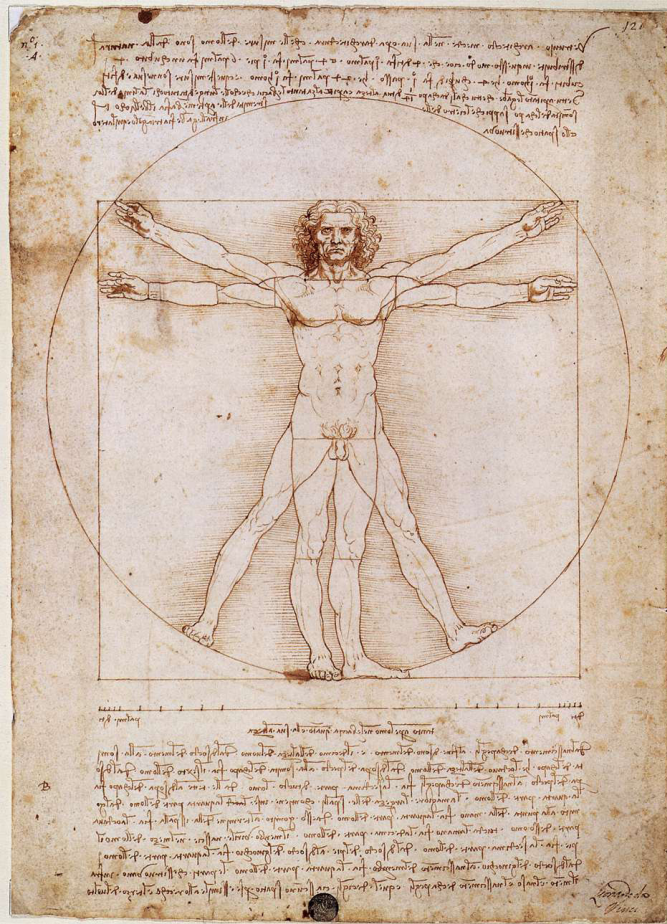Fig. 1. Königsberg Bridges before 1875.

Fig. 2. Leonardo da Vinci, *Vitruvian Man,* 1492.

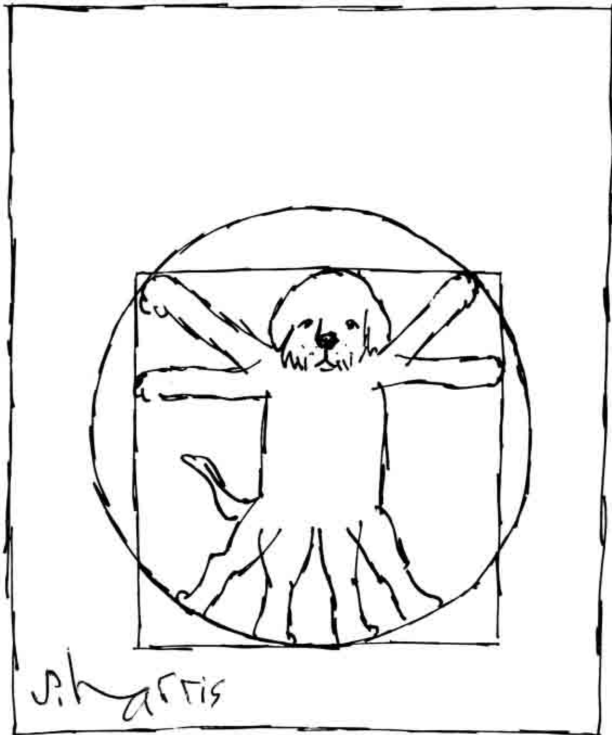Fig. 3. Friedrich Saurer, *New Vitruvian Woman.*

Fig. 4. S. Harris, *Leonardo Da Vinci's Dog.*

Fig. 5. Maggie Stiefvater, *Vitruvian Cat.*

Fig. 6. Cildo Meireles, *Inserções em Circuitos Ideológicos: Projeto Coca-Cola (Insertions into Ideological Circuits: Project Coca-Cola)*, 1970, text transfer on Coca-Cola bottles, 18 x 80 cm (Montreal, Fondation Phi).

Fig. 7. Cildo Meireles, *Inserções em Circuitos ideológicos: Projeto Cédula* (Insertions into Ideological Circuits: Banknote Project), 1970, rubber stamp, printed on both sides of a Brazilian fifty cruzados novos bill, 6.4 x 14 cm (New York, Museum of Modern Art – MoMA, 114.1993)

Fig. 8. Cildo Meireles, *Inserções em Circuitos Ideológicos: Projeto Cédula* (Insertions into Ideological Circuits: Banknote Project), 1970, Rubber stamp, printed on both sides of a Brazilian one cruziero bill, 6.5 x 14.7 cm (New York, Museum of Modern Art – MoMA, 113.1993)

Fig. 9. Paula Nishijima, *Game of Swarms*, 2019, workshop, magnetic board, magnets and magnetic threads, Mutant Institute for Environmental Narratives, Matadero Madrid
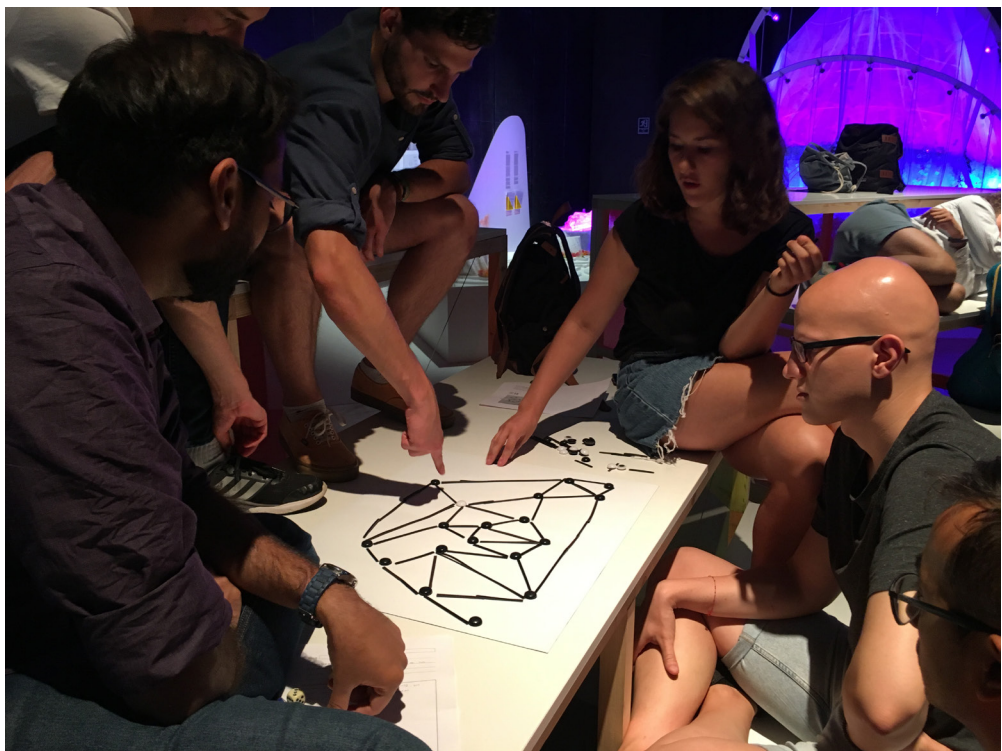

Fig. 10. Paula Nishijima, *Game of Swarms*, 2019, workshop, magnetic board, magnets and magnetic threads, Mutant Institute for Environmental Narratives, Matadero Madrid

Fig. 11. Paula Nishijima, *Game of Swarms*, 2019, workshop view,
Mutant Institute for Environmental Narratives, Matadero Madrid

Credits Illustrations

Fig. 1. Barabási, 2002, 2.1.

Fig. 2. Braidotti, *The* Posthuman, 2013, 1.1.

Fig. 3. Braidotti, *The* Posthuman, 2013, 1.2.

Fig. 4. Braidotti, *The* Posthuman, 2013, 2.2.

Fig. 5. Braidotti, *The* Posthuman, 2013, 2.3.

Fig. 6. Downloaded 15 November 2019.
https://www.artsy.net/artwork/cildo-meireles-insertions-into-ideological-circuits-coca-cola-project

Fig. 7. Downloaded 15 November 2019.
https://www.moma.org/collection/works/62048

Fig. 8. Downloaded 15 November 2019.
https://www.moma.org/collection/works/62006

Fig. 9. Author's photo.

Fig. 10. Author's photo.

Fig. 11. Author's photo.

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