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Mapping the gut buddies

Elżbieta Kowalska

Abstract

The psychosomatic reactions of human organisms to an imbalance of the gut microbiota, so-called microbiome dysbiosis, are revealing ever more gaps and ruptures in our understanding of microbial relationality. Autoethnographic threads, though not really visibly outlined, are the foundation of this text. Personal experience of gut dysbiosis evoked the need to formulate an epistemology of such intensive destabilisation of daily life. Invoking stories recounted by anthropologists, scientific claims from medical reviews, cultural studies concepts and new materialist approaches, I am critically examining different methods of representation used in mapping the assemblage of human-gut-microbes relations. These maps are crucially participating in imagining, perceiving and creating future relationships not only with humans' inner bacterial realm, but wider planetary ecologies. The article features mappings that constitute practice-based attempts to formulate personal representations of these microbial entanglements.

Keywords: assemblages; human gut microbiome; knowledge production; logic of care; mapping

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Elżbieta Kowalska



INTRODUCTION

In her article ‘The Weight of the Self: Care and Compassion in Guatemalan Dietary Choices’, anthropologist Emily Yates-Doerr (2012) makes precise and multilayered characterisations of relations observed in stories of patients seeking help in nutrition services at the Hospital Regional San Juan de Dios, the third-largest hospital in Guatemala. At the same time, the author presents prolific reflections about the practices and approaches of medical personnel managing individual treatments. The text begins with the story of Marta, one of the hospital’s patients discussed by Yates-Doerr, who visits the nutritionists’ consulting room for the first time. The description of Marta’s appointment, which, together with other patients’ narratives, is introduced in the article, is thick with details. Yates-Doerr does not omit to mention the very long waiting time of the patient for the evaluation, the supportive presence given by her daughter and sister, the way nutritionists warmly greet the patient, how the body of the patient is measured and put into numerical representation, and the comprehensive interview led by medical personnel, which revealed the patient’s body pains, her husband’s poor financial situation, as well as her worries about meeting the expectations of her family during the progress of treatment (Yates-Doerr 2012: 136).

In Yates-Doerr's text, the patient, just like each one of us, is entangled in external relations co-creating their current and future health, while living with internal neurological, mental and psychosomatic symptoms causing affective and emotional processes to occur in their body. Her article is a great example of the attempt to grasp the complexities and depths of human life – in this case people who seek professional medical help. I was inspired not only by the engagement and devotion of the author, but also by questions and doubts posed by her in the process of seeking the appropriate angles to describe her observations. I would like to concentrate on a few thoughts that remain after my reading of this text and combine them with my own autoethnographic research and mappings of the human gut microbiome. The human gut microbiome is a specific complex of microorganisms which are known for co-constituting various aspects of the functioning of our bodies. This requires me to go deeper into the inner structures of the body, in fact not with heed to our organs, but to their inhabitants.

At first, to describe this human-gut-microbial relationality in a more accurate way, I would like to propose to use the concept of the assemblage. The biological and medical term 'human gut microbiome' is, in my view, emphasising the agency of the human body and limiting the understanding of the spectrum of microbial agency. Ideas developed in this article acknowledge the inter-connectedness of various actants – humans, bacteria, organs and environments. This is why the concept of the assemblage is more suitable for naming the structures with which I engage in my work. By assemblage, we can understand a grouping which is the outcome of historical and circumstantial phenomena, arising ad hoc. In Jane Bennet's perspective, an assemblage is the gathering of various actants: humans, nonhumans, animals, plants, minerals, culture, politics and technology. As Bennet (2005: 445) writes, an assemblage is 'a living, throbbing grouping whose coherence coexists with energies and countercultures that exceed and confound it'. In the text below, I will use the term 'human-microbes assemblage' – on the one hand to get closer to an understanding of the scientific research around the phenomenon, and on the other hand for critiquing and proposing alternative perspectives on both the scientific knowledge published in recent decades in the medical literature and the representations used in the latter to communicate the problematics at hand.

This human-nonhuman, microbial and environmental assemblage is a complex and hard-to-scientifically-comprehend collective. Our bodies are populated by trillions of bacteria species, fungi, archaea and eukaryotes – they can be found in our mouth, skin, lungs, digestive organs and other parts of our body (Turner 2020: 147). All these parts of our body are inhabited by particular compositions of microorganisms, each characterising the given environment – in scientific discourse these arrangements are called microbiomes (Berg et al. 2020: 4). The one that I am focusing on in this article, living within the human colon, evinces to be an enormous bacterial community.

> When it comes to drawing up a bacteria atlas, the gut is the supreme challenge. Of our entire microbiome – that is, all the microorganisms that teem on the inside and outside of our bodies – 99 percent are found in the gut. Not because there are so few elsewhere, but because there are simply so inconceivably many in the gut. (Enders 2015:146)

The gut microbiome is responsible not only for enabling and maintaining the digestive and nutritional functions of the organism, but also crucially influences immunological, neuronal and metabolic processes (Berg et al. 2020: 16; Sonnenburg and Sonnenburg 2019: 1). In fact, even if Yates-Doerr does not specify this in her article, all dietary problems of the hospital patients described by the author are dependent on and

interrelated with the condition of the human gut microbiome.

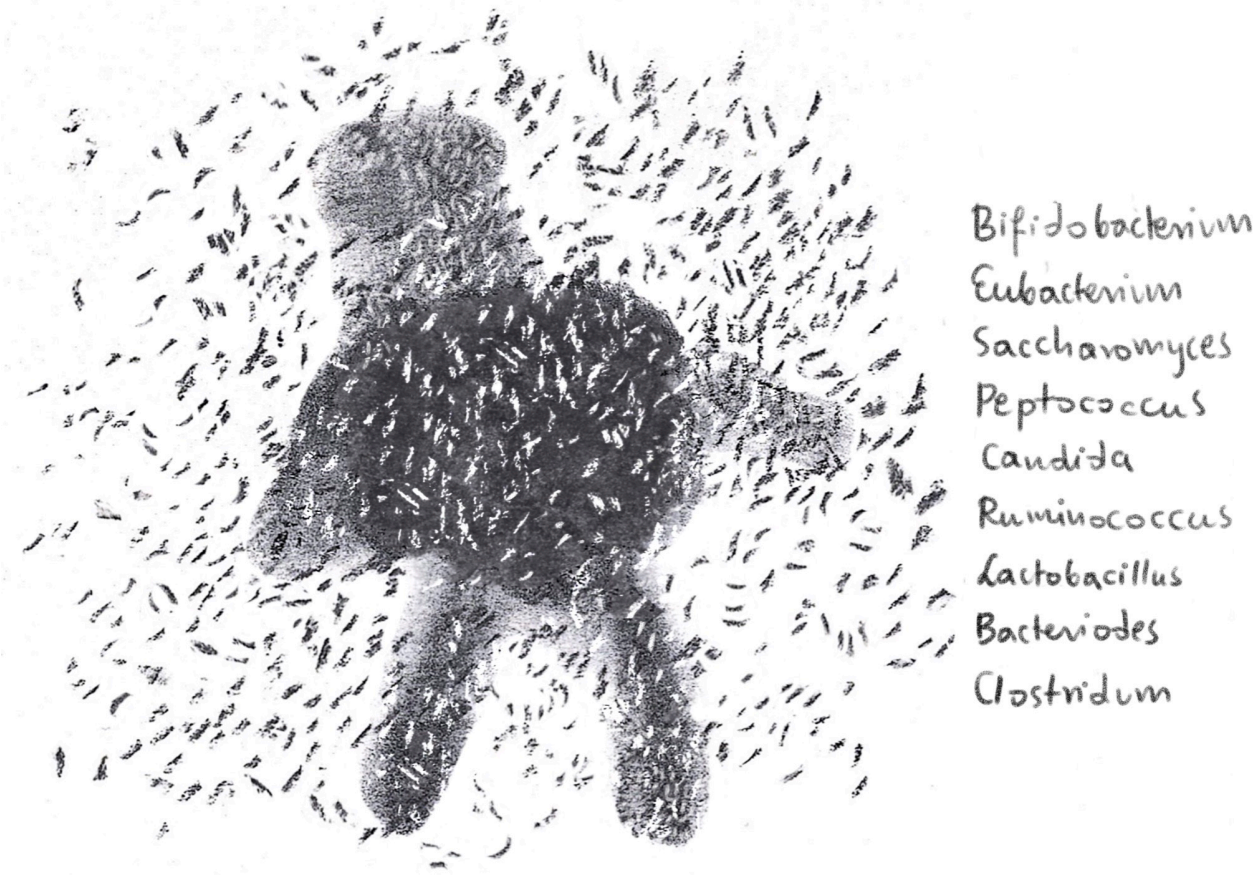


Figure 1: Elżbieta Kowalska, *Human-microbes assemblage*, hand-drawn sketch with names of some bacterial species known to be inhabiting human guts. Drawing. 2024. Courtesy of the author.

The microorganisms living in our guts are our life partners, yet their importance is still widely underestimated in popular cultural and educational circles. Billions of years ago, all life forms that existed on the planet consisted of single cells, and microbes were the only living things on Earth (Yong 2016: para. 1.19). The story of what is considered as life in Western culture emerged from those single cells. 'All the visible organisms that we're familiar with, everything that springs to mind when we think of "nature", are latecomers to life's story' (Yong 2016: para. 1.19). Bacteria lie at the heart of the majority of the processes that happen in the environment, and their loss would have deadly outcomes for many members of the plant and animal kingdom (Yong 2016: para. 1.32). As the science journalist Ed Yong writes:

> Bacteria enrich soils and break down pollutants. They drive planetary cycles of carbon, nitrogen, sulphur and phosphorus, by converting these elements into compounds that can be used by animals and plants and then returning them to the world by decomposing organic bodies. They were the first organisms to make their own food, by harnessing the sun's energy in a process called photosynthesis. They released oxygen as a waste product, pumping out so much of the gas that they permanently changed the atmosphere of our planet. It is thanks to them that we live in an oxygenated world. […]
>
> They live in the water of the deepest oceanic trenches and in the rocks below. They persist in

> belching hydrothermal vents, boiling springs, and Antarctic ice. They can even be found in clouds, where they act as seeds for rain and snow. (Yong 2016: para. 1.19)



Figure 2: Elżbieta Kowalska, *Atmospheric and organic correlations*. There is a profound correlation between the atmosphere and the living processes happening on Earth. Sketch based on a presentation made by Professor Lynn Margulis of Boston University, speaking before an audience of NASA employees in 1984 to explain the Gaia Hypothesis. Drawing. 2024. Courtesy of the author.

A major turn in the natural sciences in terms of acknowledging the importance of microbes in planetary systems was led by the American biologist Professor Lynn Margulis. Famously known for collaborating with James Lovelock on the Gaia Hypothesis, Margulis developed her own breakthroughs in biology. Over 40 years ago, in a famous speech organised for NASA, Margulis was stressing the importance of microorganisms and their regulation of the atmosphere (Margulis 1984). Microbes became known for keeping certain environmental and atmospheric aspects within a range suitable for life on the Earth's surface. They were found to be existing in very tightly organised communities, piled on top of each other, packed in huge density in rocks, grain and sands. The latter surface structures are commonly considered in Western science as non-living, yet they are 'an active portion of life' and extremely dynamic 'tissues' (Margulis 1984).

Since the beginning of industrialisation, the condition of microbes in various environments has become more and more alarming. The paradigmatic example can be found in the urban-rural agriculture-food-waste cycle, with one of its nodes situated in human dwellings. City waste full of microbiota – containing much more

than just human excrement, including toxic chemicals – is being 'flushed' from toilets to underground tunnels and circulates back to the soil and to agriculture (Kawa 2020: 145). The impact of these substances and pathogens from different sources on the soil bacteria contributing not only to food production, but also to atmosphere regulation, is enormous. The soil microbiome is known for its effects on carbon emissions into the atmosphere, and human-induced changes in this microbiome are possibly exacerbating global warming trends (Jansson and Hofmockel 2019: 1). [1] Clearly, the importance of microbes is crucial for maintaining the balance of various processes happening on planet Earth.



Figure 3: Elżbieta Kowalska, *Soil*, 2015. Photography. Near Rusałka Lake, Poznań. Courtesy of the author.

This article presents a collection of thoughts and observations which evolved around my own experience of chronic microbes assemblage dysregulation. Restoring the balance in disturbed arrangements turns out to be a very demanding process for particular individuals. The distressing loop of repeated health problems incited my attempt to synthesise my own experience with symptoms of exhaustion in the planetary microbiome. The intimate affiliation between microbial ecologies on different scales animates the two main strands of this article. Firstly, I want to present current medical claims about the human-microbes assemblage and reflect on essential issues related to maintaining good microbial relations within – and, as later introduced in the text, outside – our bodies. Secondly, I wonder what challenges might be met in case of disturbance in human-gut-microbes connections? What methods might be helpful for (re)creating a map of the everyday terrain of this assemblage? In the course of my argument, the re-mapping of human-gut-microbes relationality will emphasise the need to go beyond notions of individualism, and hence open up to what can be considered an intra-actions structure, an understanding of being based on Karen Barad's notion of intra-action. In the words of Barad, phenomena in the world emerge from the entanglement of intra-acting agencies, which are ontologically inseparable. 'It is through specific agential intra-actions that the boundaries and properties of "individuals" within [a] phenomenon become determinate and particular material articulations of the world become meaningful' (Kleinmann 2012: 77). I will return to the concept of

intra-action later in the text.

While my personal experience is situated in a different cultural and sociopolitical context, with different accessibility to, and methods and equipment used for, medical service, different availability of drugs and groceries, as well as Central European culture and 'local biologies' (Lock 2017), [2] I nevertheless find similarities between my private bearing up with bad health and the struggles of the patients described by Yates-Doerr. These similarities signify widely materialised complexities of the relations that surround the destabilised human body, which deals with microbiome-related imbalance. Therefore, scientific claims 'pumped' into this article had to be critically evaluated. Currently existing and widely accepted medical discourses and practices propose certain constrictive framings of the subject while marginalising the presence and agency of bacteria. Yet, bacteria turn out to be crucial agents which affect not only organisms' well-being, but also atmospheric balance. I want to concentrate on how these complex and hard-to-understand microbial relations are expressed by representations commonly used in Western medical science, particularly how these representations mediate perceptions on the topic of the gut microbiome. Oscillating between reflections on both Yates-Doerr's inquiry and recent medical insights, this article concentrates on different approaches to mapping the human-microbes assemblage.

This suggests a brief excursion into different histories and cultural significances of mapping. The map is considered an elementary human navigational device resulting from the human perceptual system. History shows that maps developed by humans varied across different cultures, but due to colonial domination, Western representations of space are particularly popular around the globe. For Agnieszka Jelewska, the reasons for and outcomes of creating terrestrial globes (with the first one having been proposed by ancient Greek philosopher Crates of Mallos and the oldest existing model made by cartographer Martin Beheim in the fifteenth century) was to design a medium for 'establishing the Earth as legal ownership of those who arrive and explore' (Jelewska 2019: 14). Thus, European cartography is inseparable from imperialism, colonialism and the shaping of the conquered world. The subsequent exploration of lands by Europeans was intended to serve the purpose of territorial expansion and the growth of the wealth of Europe, based on the appropriation of additional lands and the exercise of control over humans and non-humans (Jelewska 2019: 14). Cartographic means resulted in highly mathematical and ordered forms of representation, which flatten three-dimensional space to two dimensions and divide space into points, lines and grids. Mathematical calculations are the base of these projections, meant to represent 'true and objective facts' about the world, while in fact being subjective and biased (as most of cartographic projections were proposed by men and can be mathematically accurate only within a certain range, as is shown by the discussion raised around the ubiquitous Mercator projection [Monmonier 2004: ix–x]). As Timothy Morton writes, the European fantasy of empty and smooth, container-like space – the Euclidean proposition – was a concept that collapsed when other scientific theories of space emerged, like the theory of relativity or that of spacetime (Morton 2018: 7).

In contrast, embodied, conceptual and performative maps were developed worldwide outside Western cartographic practices, such as the sandpaintings created by Navajos, known to be used in healing practices. Sandpaitings relied on ritual creation of highly specific patterns from coloured sand by a medicine man, accompanied by community chanting (Lewis 1998: 109–110). Sandpaintings do not aim to objectify the world, but to rebuild lost connection with spiritual beings, while taking up a subjective and situated position through embodied performative acts. Numerous examples of different Indigenous maps, which opened up the field for discussion around the purposes and agency of European cartographic methods, can be found in the literature (e.g. Harley and Woodward, 1988). Examples such as these show that maps

across cultures have been created for various reasons and display significant differences in terms of formal means of expression.

Informed by these observations, this article contrasts different attitudes to mapping together with their effects on knowledge production and medical practice. The text is accompanied by visuals, both from online sources or designed by myself. While creating representations for this article, I found a need to use different means to visually present issues important for the subject area. Some of the figures made by me are black-and-white charcoal sketches, kept in an intuitive, naive style. Charcoal is a medium which I intentionally chose to experiment with in the search for appropriate body gestures that translate to visual forms, because it feels more intimate and personal as a medium than other analogue or digital means. I find the practice of drawing to be a generative act that brings new perspectives and that might widen or turn the imagination towards new ideas. The simple, loose style used in some of the figures is in my view a proper way of articulating the story being developed here, which is not seeking perfection, but rather is looking for an intuitive connection.

MULTITUDES CONTAIN ME

Returning to the topic of human-microbiome relations, according to current research on the human gut microbiome, the latter is not only responsible for the regulation of the immune system, but also has a profound impact on all sorts of physiological and psychological processes happening in the body. The gut microbiome takes part in constituting our mood, memory, appetite, metabolism, responses to stress, quality of sleep and more. The establishment of human-gut-microbiome relations starts at birth, when the infant's body is inoculated with a number of microbes during delivery. In the case of delivery through the birth canal, the microbiota of the infant is akin to a blend of vaginal and faecal bacteria of the mother, while during caesarean section, microbes from the maternal skin and the hospital environment are passed into the infant microbiome (Sherwin et al. 2016: 14). The environment encountered has a profound impact on the newborn's microbiome composition. Scientific research shows that a child delivered through caesarean section has fewer bacterial species that are important for the health, stability and variety of the infant's own microbiome (Sherwin et al. 2016: 14). However, these differences might be influenced by other factors – significant contributors to the condition of the microbiome are maternal diet and child breastfeeding, for example (Logan et al. 2016; Rinninella et al. 2018). These elements, coming from the mother's body, are considered to be the key determinants of the infant body's inhabitation by microbes. Without achieving a stable and varied gut microbiome, the nervous and immune systems of the organism are in a vulnerable position. The bacterial environment encountered in the first years of life is essential and contributes to the organism's overall health. The gut microbiome holds a decisive position in the protection against pathogens, as only an immune system supported by balanced microorganisms might fight bacteria and viruses that attack the human organism (Koontz et al. 2019: 252). However, as already mentioned, the stability and variety of the gut microbiome is not only contributing to the immune system, but to the overall health of the body (Logan et al. 2016).

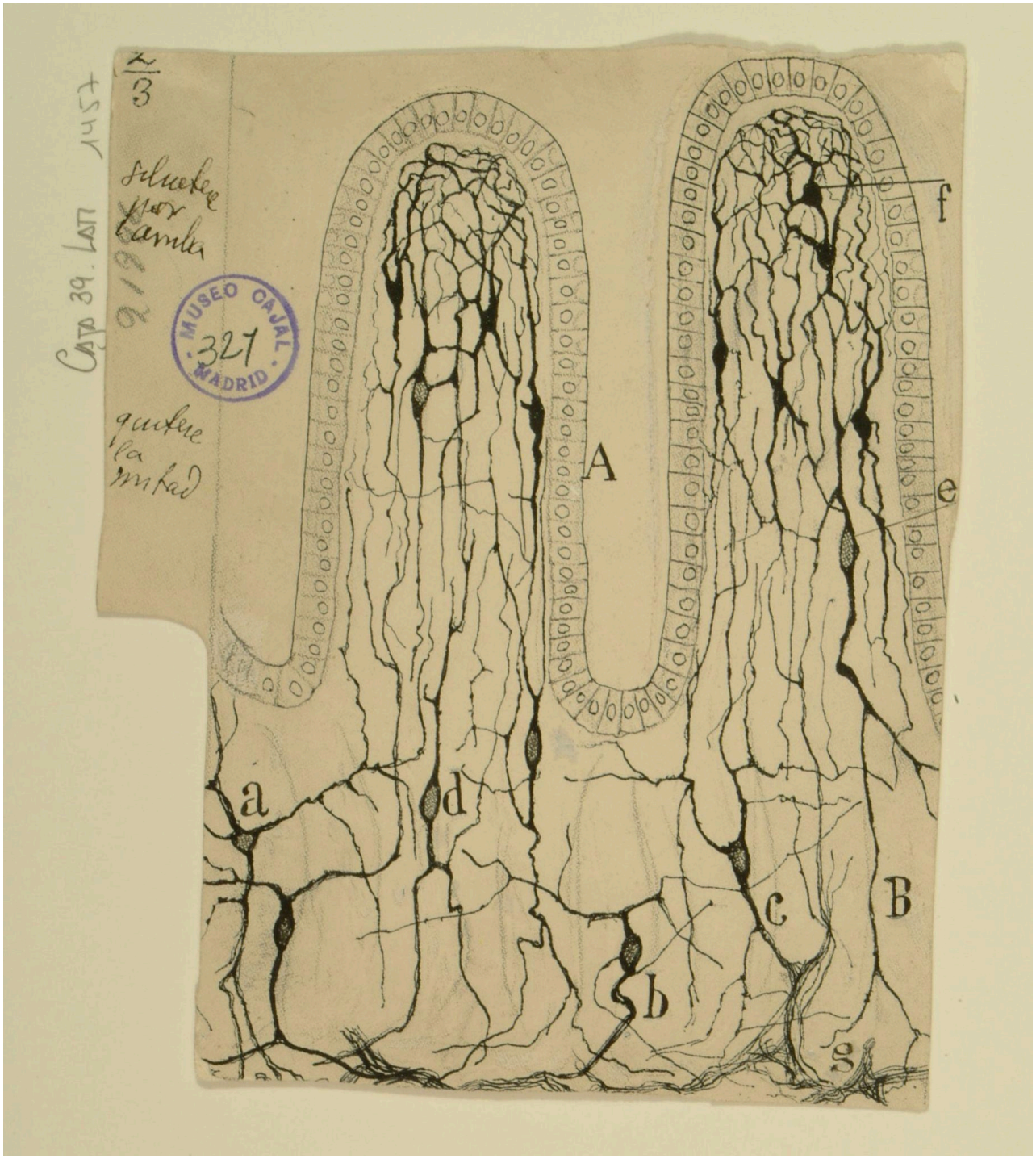


Figure 4: Santiago Ramón y Cajal, Interstitial Cells of Cajal. Drawing. Courtesy of the Cajal Institute, Spanish National Research Council.

Gut bacterial arrangements evolve together with their host as the newborn's microbiome starts to resemble an adult's microbiome. The general gut microbiome structure is also intertwined with the influence of particular ethnic and cultural dietary habits. For instance, studies conducted among Italian, Burkina Faso and Hadza hunter-gatherer communities showed different dominating and sub-dominating bacterial phyla (Schnorr et al. 2014: 2). Cultural dietary habits and environmental variations lead to differences in the microbiota, which undoubtedly are affecting biological processes in the human body. However, the question

of the composition of a 'healthy' microbiome is still unresolved. While the processes of many research projects are thoroughly planned and conducted, such as those of the Human Microbiome Project or the Earth Microbiome Project [3], scientists have only been able to identify partial traces of what might be identified as general criteria for a healthy bacterial arrangement in the human gut and, in a wider framework, regarding Earthly soil systems.

General balance and symbiotic relations remain the key issues. Yet, why are symbiotic and hence collaborative relations so important when it comes to bacterial communities, including those present in the human gut? The answer to this question was comprehensively delivered by Lynn Margulis who, besides acknowledging bacteria's importance for maintaining life processes on Earth, presented the notion that symbiosis is the primary driver of bacterial evolution (Sapp 2017: 51:51:00–52:21:00). While trying to answer the question of how a bacterial cell evolved to a nucleated cell (the kind that enabled the development of protists, fungi, plants and animals), Margulis reached out to the already present theory of symbiotic relations in bacterial communities and explained it in an evolutionary and ecological context.

> Two bacteria, very different kinds of bacteria, probably got together and ended up using the oxygen. The first of these bacteria simply broke down sugars and in fact could not use the oxygen at all. The second took the breakdown products and with oxygen bound them essentially and drew a lot of energy from that. And the two together made a complex and this complex after a long period of time and many changes became a very successful kind of organism. In fact, it is that kind of organism that is the ancestor to all eukaryotic cells. (Margulis 1979: 48:22:00–48:56:58)

> Bacteria, and acquisition and integration of bacteria into other organisms is a form of symbiogenesis. It is a form that is the most important way that novelty is generated in the evolutionary process. (Margulis 2005: 53:50:56–54:04:30)

Putting collaboration rather than survival of the fittest into the spotlight, Margulis changed the view of how the everyday functioning of these little organisms, and other organisms and environments that they inhabit, is perceived. 'In other words, we are made up out of deeply collaborative bacteria' (Harding 2017: 49:39:00–49:45:00). Hence, symbiosis is the condition that is deeply rooted in the beginning of our bodily functioning. It is the driving force for the growth, creation and participation in life-enabling processes. Collaboration is at stake when it comes to the balance of the human gut microbiome and the rest of the body.

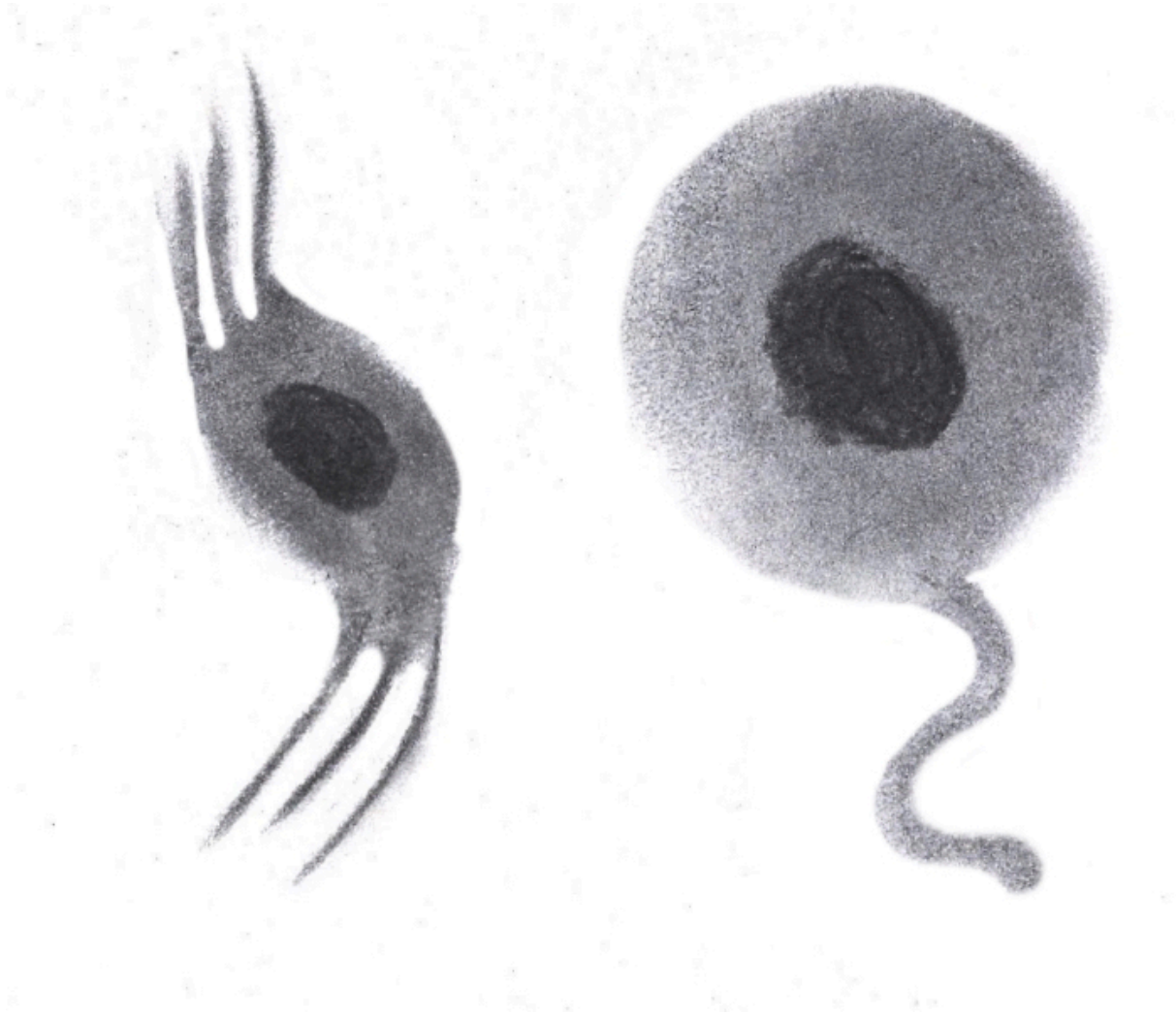


Figure 5: 9 Elżbieta Kowalska, *Common elements*. Sketch of a bacteria cell (on the left) and a human cell (on the right) which are known for sharing some parts of their DNA (dark spots inside the cells). Drawing. 2024. Courtesy of the author.

Meanwhile, the pathogenic state of the microbiome, called dysbiosis, is a condition far from balanced relations based on mutual collaboration (Berg et al. 2020: 13). It is antagonistic in terms of the sharing of food and space – each bacterial phylum is fighting for its own advantage. Thus, processes like absorption and delivery of nutrients, control of hormone levels, regulation of neurotransmitters, support of the immune system, etc., are disturbed and the whole body is affected by this lack of collaborative relations in the gut (Sherwin et al. 2016).

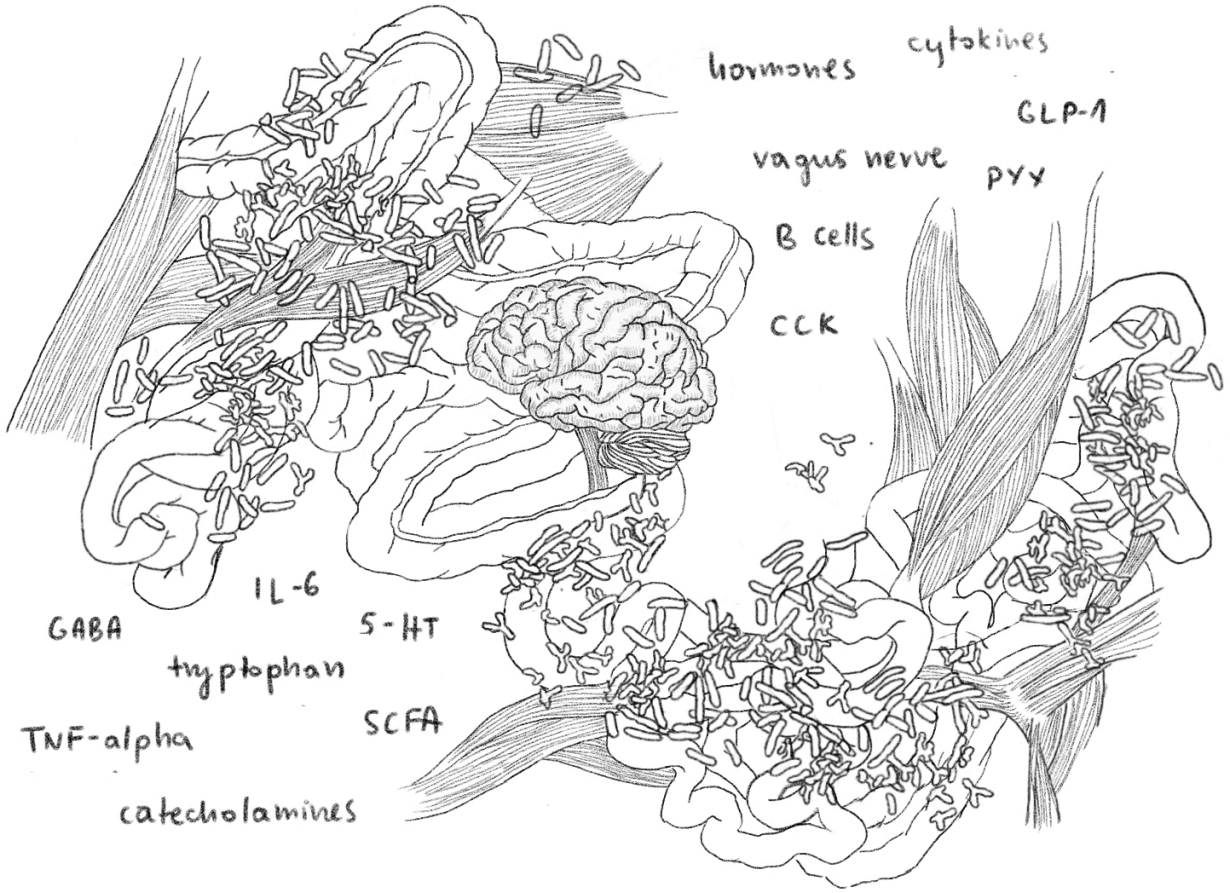


Figure 6: Elżbieta Kowalska, *Key communication pathways of the muscle-gut-brain axis* . This depicts possible gut microbiome ways of communication with the brain, which include the vagus nerve, short-chain fatty acids, hormones, muscles, enteroendocrine cells etc. Based on an illustration from Sherwin et al. 2016. Drawing. 2024. Courtesy of the author.

The authors of the Forum on Microbial Threats (2006: 5) [4] systematise our relations with microbes around three divisions. Microbes are either symbionts that establish a mutually beneficial relationship with the human body; commensals, which derive benefit without harming the human body; and parasites that can cause an infection. Researchers assume that communication between these bacteria and parts of the human organism is taking place via various biological mechanisms – the vagus nerve, short-chain fatty acids, enteroendocrine signalling (Sherwin et al. 2016) and many other hard to detect and understand structures and processes. These connections between the gut and neurons have been explored by physicians and scientists since the early 1900s (Fig. 6). The main and most recognised of these communication pathways is called the gut-microbiota-brain axis, an extensive network of neurons established between the brain and the microbiome. It is also termed the muscle-gut-brain axis, to stress the importance of muscles and body movement in influencing the condition of the gut microbiome and vice versa (Schlegel et al. 2019: 861). This neuronal network constitutes the enteric nervous system, often called the 'second brain' of our body (Sonnenburg and Sonnenburg 2015: para. 12.3). The findings of current research on the human 'second brain' appear to be a game changer in thinking about our bodily entanglements and processes. 'The collective genomes of the microbiota in the human gut [...] is approximately one hundred-fold larger than that of its host' (Forum on Microbial Threats 2006: 7). Consequently, the relations of humans and their

microbiomes appear undoubtedly – and in the case of pathogenicity, problematically – to be tied up also on the genetic plane, as the human 'genetic landscape' is considered to be an amalgam 'of the human genome and the microbiome' (Forum on Microbial Threats 2006: 7). While we are the 'composite of genetic species', there are many agents essentially influencing each other within human bodies on a daily basis (Forum on Microbial Threats 2006: 7). Hence it is no surprise that a dysregulated, pathogenic gut microbiome has been found in patients with neuropsychiatric disorders such as autism, schizophrenia and depression, Parkinson's disease and obesity (Sherwin et al. 2016; Wallen et al. 2021). Yet the main genetic cause, whether it is bacterial genes or human genes that lead to development of pathogenesis, is still unknown (Wallen et al. 2021). At the same time, shifts in our gut microbiome do not have to be related to any serious health condition – scientists who study animal-gut-microbial relations claim that less intense and short-term shifts are known to be happening daily, influencing our mood and a broad range of feelings and behaviours (Wu et al. 2021: 409; Archie and Tung 2015: 31). What if, in light of all this, our point of view needs to be repositioned to assume that, paraphrasing the title of a book by Ed Yong, 'multitudes contain us' (Yong 2016: para. 1.26)?

AN INCONCEIVABLE AND INDISPENSABLE FIELD MAP

While the remarks above cover some of the current knowledge in this area, introducing all the recent research on the human gut microbiome might turn out to be a limitless endeavour due to the immensity of the topic. From the perspective of a newcomer, positioned outside of professional medical discourse, dealing with vast amounts of information can easily turn out to be a deeply confusing experience. I was a newcomer myself, and I felt an urgent need to arrange knowledge traces into specific combinations that would help me orient myself in this new territory, the territory of the destabilisation of more-than-human-microbial assemblage of which I was part. Attempts to create an epistemology of this process might be seen in the formulation of the concept of 'cognitive mapping'. This has been developed in scientific experiments conducted on rats regarding their cognitive possibilities, led by psychologist Edward C. Tolman. Tolman studied the rats' behaviour while finding their way in a maze. He came to the conclusion that something like a 'field map' was established in the brains of these mammals. This map enabled the rats to achieve certain goals while finding their way through the labyrinth (Bjornson 1981: 52). According to Tolman, this cognitive map has a kind of schematic, elastic structure that allows individuals – rats, humans and possibly other mammals – to create hypotheses about the world, which can then be tested and modified when confronted by a specific situation (Bjornson 1981: 52). Tolman claimed that the goals of an organism can only be realised when it has 'succeeded in synthesising a functional subjective representation of that environment from the fragmentary bits of information received through previous contacts with the object world' (Bjornson 1981: 52). The brain, in Tolman's understanding, must have evolved in such a way that it enables the mapping of an external environment, and organisms must be endowed with 'an exploratory impulse which motivates them to undertake this mapping' (Bjornson 1981: 53).

Following Bjornson's findings, interest in cognitive mapping travelled from psychological studies to geographical, urban and cultural discourses. The term became popularised by cultural critic Fredric Jameson, for whom cognitive mapping is a methodological project for capturing 'the postmodern global whole' (Kusiak 2017: 32). In Jameson's proposition, cognitive mapping is supposed to lead to a practice of

overcoming modern human disorientation in late capitalism's gigantic global networks, an effort as inconceivable as it is politically indispensable (Kusiak 2017: 32). I want to concentrate on two particular aspects mentioned by Jameson. After Kevin Lynch [5], Jameson asserts that the process of synthesis leading to a functional [6] cognitive map is interrelated with the level of 'legibility' of the mapped space. This conception may be extended by considering James Gibson's theory of affordances. Gibson understands affordances as particular sets of what an environment itself is offering for living beings, e.g. 'affording' them to have specific perceptions, interactions and communications with their surroundings (Gibson 1986: 127–28). Therefore, 'low legibility' of space can be understood as a lack of peculiarity for an individual set of affordances that may result in experiences of disorientation, alienation and mental unmapability (Jameson 1988: 350). Revisiting the previously introduced potential effects of microbiome disruptions influencing an individual's body, sets of affordances can also be seen to play out within bodies, affecting their exterior relations. It matters how the human-microbes assemblage 'affords' a human organism to perceive, interact and communicate with its environment and other beings. These relations influence what is offered, and thus what is possible, to a map-maker. The second issue raised by Jameson concerns the aesthetic representation through which the project of the cognitive map may be realised (Jameson 1988: 350). In his book *Postmodernism, or, the Cultural Logic of Late Capitalism*, Jameson leaves open the question about the form of mapping, as he finds himself incapable of proposing anything specific. Whether it is a specific 'project' or an everyday 'field map', in both cases cognitive mapping is carried out through representations accessible in everyday life. Finding the right form for a cognitive map would require thinking extensively about times, spaces and matters which are being mapped in relation to the body or bodies involved in the mapping. It must be taken into account that different forms of mapping can highlight different kinds of relationalities. In seeking ways to conceptualise human-microbiome relationships as assemblages in their full abundance, critically examining dominant representations may prove particularly crucial.

PICKING UP REPRESENTATIONS

In transposing reflections about identifying representations of a cognitive map to the mapping of human-microbes relations, it is worth first considering the means that are commonly used in Western medical practice in the process of constructing daily 'field maps' of the patient. These practices are widely in use around the globe, also being part of imperial and colonial enterprises that have destroyed or marginalised other healing and curing practices, and they remain part of broadly applied norms in medical practice. In Yates-Doerr's text, the treatment of patients in a Guatemalan hospital is mostly based on Western medicine. [7] Western medical practices are established on the authority of Western sciences, enforcing an objectifying way of perceiving the processes and relations constituting our body. Human-microbe assemblages are communicated in peculiar linguistic and visual representations, predating but also constituting the foundation for the recent development of modern biometric and algorithmic tools for the quantification of the body (Thacker 2003; Wernimont 2018).

As Judith Butler (2015: 22) writes, we cannot escape knowing our bodies through our language. While considering the relations between consciousness, embodiment and language, Butler tries to imagine other ontologies separate from linguistic ones that could be used as proof that 'the body exists outside of language'. However, her efforts fail to supply those other modes of understanding (Butler 2015: 21).

Language seems to be preceding the body and predetermining how it emerges and experiences reality, which again has enormous social and cultural impact. In linguistic medical conventions, it is common to define the relations between a microbiome and its habitat as the 'bacteria and their host'. In relation to this, I want to mobilise a proposition made by Joseph Hillis Miller to help unfold the connotations between the symbolic figure of the host and its symbiotic or parasitic relations with bacteria inhabiting the host. The host itself is named to be the food, 'his substance consumed without recompense' (Miller 1977: 442). According to Miller, the modern English word 'host' is derived, among others, from the Latin *h*ospes, which is based on the word *g*host-pot, meaning 'master of guests', 'one who symbolises the relationship of reciprocal hospitality' (Miller 1977: 442). The question is, does this etymology suggest the superiority and domination of the master over visiting guests? In the context of this inquiry, this suggests the need for contrasting the symbiotic and pathogenic states of human-microbe assemblages, as the case of bacterial dysregulation leads to the emergence of insights that might stay unnoticed if the system is considered only while working in symbiotic relation.

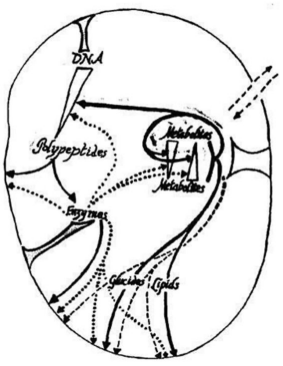


Figure 7: Humberto R. Maturana and Francisco J. Varela, Illustration of the autopoiesis system, 1980. Drawing. This figure depicts the authors' idea of 'the general form of closure with respect to production and constitution in a recursive network realized as a concrete unity' (Maturana and Varela, 1980, p. x). There is a small opening of the system for exchange with the environment. Courtesy of Maturana and Varela, 1980, p. x.

I find it interesting to think about symbiotic and pathogenic conditions together with the proposition of the autopoietic and allopoietic organisation of living systems put forward by Chilean biologists, cyberneticians and philosophers Humberto R. Maturana and Francisco J. Varela. The first term, the autopoietic system, assumes self-contained, autonomous entities, set in a closed loop constituting a recursive network of self-production (Maturana and Varela 1980: 75–84). Autopoietic bodies are based on homeostasis with their own organisation through which they maintain their continuity, and this can refer to various living beings. The Chilean scientists also proposed that in opposition to autopoiesis stands an allopoietic system (*allo*-, Greek prefix meaning 'other', 'difference'), producing something other than the system itself (Maturana and Varela 1980: 80–81). An allopoietic system exceeds self-production and reproduces otherness, akin to the figure of an assembly line which produces something different to itself. Both autopoietic and allopoietic systems are referring to entities that are living within an environment or larger systems, but remain distinguishable unities.

Thinking about microorganisms residing inside the human gut, these could be considered autopoietic systems enclosed and interrelated with the human-microbes assemblage. Now, let me propose a

hypothesis, one that might not be directly in line with Maturana and Varela's thinking, but that uses their thought as inspiration: the idea that the autopoietic system in question is actually a human-microbes assemblage whose condition is symbiotic, hence reproducing certain balanced and previously established structures. What then happens to the idea of this assemblage as an autopoietic system when it goes beyond or outside the symbiotic relation? Can a body in symbiosis with the microbes that inhabit it be assumed to be autopoietic until the assemblage loses its organisational closure when becoming allopoietic? This would mean that an unbalanced, pathogenic state unsettles an assemblage's recursive network of self-production, hence giving rise to something other than the system itself. Maybe this change to an allopoietic state would be appearing only at this moment when the assemblage's condition diametrically changes, together with increased relationality and 'permeability' towards the surrounding environment (Fig. 8). Further reflections on what is generally considered as 'self' and 'other' probably would be helpful here. What I find interesting in these briefly outlined reflections is how the bodily organisation of the human-microbes assemblage is fluctuating between self-production and production of something 'alien' or 'other than itself', in connection with states of balanced or unbalanced relations. I would like to leave this problem open for future elaboration.

Returning to Miller's musing on the figure of the 'host', these proposals give rise to a number of questions. Is the gut microbiome actually a guest in the human body or is the relationship instead based on host-to-host interaction? Can we call microbiomes non-human if bacterial communication and movement influence humans too? Is any notion of mastery becoming untenable in light of this? What are the qualities of our organisms' permeability? How far does the agency of the gut bacteria exceed our bodies? Should they be included in a hierarchy of organisms, and is setting up a hierarchy a good idea at all?



Figure 8: Elżbieta Kowalska, *Permeable Structures*, 2021. Illustration. Courtesy of the author.

The last two questions are heedlessly venturing into the field of spatial visual imagination about microbial relations. They are constructed around matters structured in specific territorial arrangements. In what ways are microbial relations spatially and visually depicted and made accessible to the patient? In Western medicine, the representation of the bacterial world within us and its correlation with other corporeal elements is widely based on quantum media, [8]

that is ‘media that count, quantify, or enumerate’ (Wernimont 2018: 1). These practices are listing the quantities of minerals, molecules or cells, the detection of the presence of viruses or bacteria, the time of taking the sample etc. Blood, breath, urine or stool tests conducted in Western medical diagnostics deliver their results in numbers, commonly visualised in a tabular form. In this realm, numbers are visibly exposed, they have pivotal meanings and are firmly tied up to the patient’s ultimate question, ‘Am I good?’. Here this ‘good’ condition refers to medically predefined norms, not the unknown complexity of collaboratively composed human-microbe assemblages. Numbers occupy the position of oracles for the future; designed to instruct their reader about the state of facts, they are simultaneously open for the development of further predictions. Numerical results serve ‘a common assumption that numbering is always about the pursuit of precision’ (Day et al. 2014: 124). However, numerical data remain hard to decode for those who do not possess professional or specialised knowledge of the field. While deciphering the numbers, I also had many questions about machines used in the medical laboratory, more specifically, the operation and condition of the machines that calculate the ‘facts’. Just as numbers seem to be representing the facts, tables (likewise charts or graphs) mistakenly conjure up a feeling of presenting objectified and complete results of the inquiry in question. The table, with its origins in seventeenth-century record keeping, accounting and the slave trade (Wernimont 2018: 23–24), has deeply inscribed structuring and aligning properties, presenting content as ‘neither mutable nor combinatoric’ (Drucker 2014: 87–88). Results presented in this gridded and ordered structure are unwittingly considered by the reader as fixed entities (Drucker 2014: 88). The enclosed tabular form seems to be presenting the completeness of reality, everything that was ‘there’ to capture. This characteristic is still often overlooked. The signification of overall appearance is taken for granted because of its simple, clear and ordered form.

The above-mentioned forms are used for presenting the outcome of the laboratory work conducted on the collected tissue from the patient’s body. How is a test made, what are the possibilities of the machines used in the medical laboratory, when is the sample delivered and in what condition – these and many other factors affect the final numerical and visual representation. Experiencing numerical representations of my well-being in the form of blood, breath and stool tests was personally alienating for me and difficult to translate into felt and lived intra-active processes. In quantum media, the complexity of the human body and its relations is reduced into a formalised, categorised language, coerced into a more-or-less legible shape designed to be read by specialists. However, human-microbe assemblages go beyond highly depersonalised and abstract depictions that are present in the diagnostic systems of Western medicine, both in the linguistic and visual domains. Cognitive mapping of the human gut microbiome would mean engaging various complex forms of representation, not only visual and linguistic ones, but also extending into performative, haptic, spatial and temporal areas.

THE FIELD MAP OF THE ‘SHARED SELF’

The above description of representations used in Western medical practice shows the patterns commonly used for understanding and communicating human-microbe assemblages. It also gives insight into peculiar conceptions that newcomers to the topic might encounter. These representations are obviously unable to capture the dynamics and complexities of human-microbe assemblages. Now I would like to focus on what I find fundamental for an understanding of these complexities, which is also the point of departure for

creating any forms of representation that account for the latter. In the next paragraphs I will discuss the conceptual themes of the 'shared self', which clarify the idea that the responsibility for individuals is never a concern solely for the individual, and 'intra-actions', in which individuals are seen as materialised in relations rather than preexisting as such. Both ideas can be taken as models for understanding ecological relations across multiple scales. I would like to stress that the concepts developed below thoroughly undermine any notion of infallibility of any representation of human-microbe assemblages as such – no matter whether it is based on quantitative or qualitative methods. Rather, it shows how a singular representation will always be insufficient for communicating these complexities.

Returning to Yates-Doerr's text, Marta is one of the many poor people seeking help in the Guatemalan public hospital, a clearly overloaded public medical service. Sitting on the corridors' cold broken benches, quiet crowds are waiting from the early morning hours, just to increase their chance of admission (Yates-Doerr 2012: 141). The experiences described in the interviews with Guatemalan hospital patients are filled with anxieties and fears, often leading to social isolation; they endure waiting times in search of help or for continuation of treatment. Many of them are already familiar with the feeling of loneliness which accompanies the undertaking of healing oneself on one's own, or the time, finances and energy consumed by the reorganisation of fitting their lives around medical prescriptions.

Yates-Doerr puts forward valuable criticisms of rules on which medical claims in health care institutions are based. After a dozen or more months of detailed observations, supported by regular presence during consultations, recording and listening to interviews, the conclusions arrived at by the author identify these relations as intersubjective, 'highlighting a shift in responsibility away from the individual and onto a 'shared self' (Yates-Doerr 2012: 152). The body and mind of the patient, together with their condition, extend onto a wider social field (Yates-Doerr 2012: 152). It was never a concern only of the individual, but a communal one. This for Yates-Doerr stands in contradiction to claims commonly made by the Public Health Nutrition (PHN) community that diet-related illnesses are generally 'best managed by individual choices', emphasising individualisation and self-management (Yates-Doerr 2012: 136-137). For Yates-Doerr, both the PHN perspective and World Health Organization treatment strategies for dietary-related illnesses construct the notion of the patient as a solitary self. Individuals are obligated to make '"responsible" and "rational" [...] calculations and choices serving their own self-interest' (Yates-Doerr 2012: 153). Yates-Doerr references the work of Marilyn Strathern, for whom the constant referring to individual choices and the passing over of the importance of social and environmental factors is built upon the foundation of Western cultural conventions. In Strathern's understanding, the Western ontology of personhood 'imagines a complexity and diversity in selves and agents, but not in relationships' (Yates-Doerr 2012: 153). This ontology stands in utter opposition to the histories and lives of the hospital visitors discussed by Yates-Doerr. The relations of care existing between the patient and their family, as well as between nutritionists and the local community, testify to their pivotal meanings for the processes of healing. It is easy for me to observe how the patient's attitude to their health condition changes when medical numerical results are explained with guidance from medical personnel, which helps induce a calmer sense of well-being and a focused mindset. The performative aspect of conversations held in the consulting room brings new perspectives and meaningful interpretations. Wider sociopolitical and environmental factors also come to the fore, which are hard-to-grasp 'absent causes' (Kusiak 2017: 33) in the capitalist realm. Yates-Doerr clearly points out problems related to treatment stemming from the fact that so many products in the prescribed diet are outside the financial range of the patient's family, or they are simply not available on the local market (Yates-Doerr

2012: 144). The trouble of healing does not confine itself within local boundaries but extends onto wide socio-economic-ecological networks.

However, stressing the importance of relationships is not about writing off the agency of the 'individual'. In Yates-Doerr's stories, the agency of the patient – which is here considered as 'more-than-human-microbiome amalgam' – is present in their will to modulate their daily life in order to feel better. These actions require a lot of work, engagement and finances on the side of the patient. Moreover, the main task, which is examining their bodily condition and keeping up with the assigned medical treatment, often needs to be done in solitude. It requires malleability of human-microbiome thoughts and body. This malleability can also be found in the patient's opening up for collaboration with the nutritionists while still living in discomfort, fatigue and pain.

These complex human-microbes assemblages show the inadequacy of experiments and practices based on the idea of individualism – 'the belief that there are individually constituted agents or entities, as well as times and places' (Kleinmann 2012: 77). As mentioned earlier, an interesting concept for encountering these intertwined relations is proposed by Karen Barad with her term 'intra-actions' (Kleinmann 2012: 77). In Barad's writing, an interaction is commonly seen as a relation between individuals – independently existing entities and agents – that preexists their acting upon one another. In the present context, interaction would signify the separate existence of the gut microbiome and the human, between whom a connection is established in the interaction. Understood as 'intra-action', on the other hand, the relation constitutes the individuals – without relation there would be neither entities nor their properties. Intra-action means unsettling the structure of individualism. Individuals do not pre-exist as such, but rather materialise in the intra-action, so that both the 'human' and 'gut microbiome' are taking part in this materialisation, not being able to exist a priori to this relation. At the same time, the boundaries and properties of the gut microbiome and the human are being negotiated within a particular pattern of how matter, space and time are entangled – how they are intra-acting in myriad ways and on myriad levels at once. This would mean that individualist differentiations between microbiomes and humans are insufficient, as are those between host/guest or auto/allopoiesis. The sense of destabilisation and repeated failures to balance the more-than-human-microbiome amalgam revealed to me another dimension of how 'gut feeling' is deeply intertwined with the complexity of the bacterial realm. This process, which lasted a long time, allowed me to understand that agency and responsibility for what I called 'personal well-being' are shared between individuals, microbiota, environments, socio-political conditions, various time-spaces and so on.

In his book *The Three Ecologies*, Félix Guattari (1989) introduces the idea of ecosophy, which is an ethico-political proposition based on three ecological realms – the environment, social relations and human subjectivity – for the purpose of tackling modern problems arising from global markets targeting Western individualism, the reinforcement of new form of ubiquitous capitalism and harmful techno-scientific transformations, among many others. Our focus must be once and for all shifted from the subject towards the relations created between our bodily entanglements, society and environment – just as is proposed in Guattari's three ecologies.

All the maps we humans create are simultaneously co-created by microbial relations and larger, social, environmental ecologies, because we speak from the depths of intra-active processes. Like responsibility, agency is shared. This must be our starting point in an attempt to imagine a map of the 'shared self'. Perhaps the best representation for this map would be a mix of social effort, personal drawings, movement

notations, photographs, intimate notes, singing, interviews etc. – but only if its primary focus were the complexity of the relationships of the three ecologies.

OPENING NOTES

In this article, I wanted to show the great importance of considering the epistemic qualities of mapping human-microbe assemblages. Commonly used representations in Western medical practice remain insufficient for expressing or communicating these corporeal and collectively situated complexities. Yet rather than simply standing in opposition to certain scientific or social discourses, practices, methods or tools, I propose, after Guattari, to undertake a radical practice of reconsideration of ourselves (Guattari 2000: 68): our motives, ways of imagining and seeing the world, creating and sharing knowledge, understanding and getting into relations with matters.

Just like this reconsideration, or re-imagination, cannot lead us back to a state of so-called 'purity' of living with so-called 'nature' or society, we cannot forget that ideologies, methods or technologies are never neutral. On the contrary, they create a certain landscape, favouring particular views and agents. Current medical research shows that there is a need to care for the wide range of microbiome-related illnesses, and this practice must be coordinated towards commonly accessible and affordable healing practices. Due to exhaustive industrialisation, especially Western societies experience a litany of chronic diseases as microorganisms are vulnerable to toxins and chemicals (Logan et al. 2016; Sonnenburg and Sonnenburg 2019; Koontz et al. 2019). Moreover, the strength and richness of the human microbiome is depleted by 'germ wars' observable in excessive hygiene and antibiotics dosing, highly-processed and low-fibre diets, disturbance of the circadian rhythm, etc. (Sonnenburg and Sonnenburg 2019: 1). The warming climate also is a factor that is predicted to be causing the impoverishment of gut microbiomes (Bestion et al. 2017; Ray and Ming 2020). This will have effects on organisms' stability and the strength of the immune systems needed for fighting pathogens – such as the SARS-CoV-2 virus.

Prevailing healing practices are interrelated with the medical industry and market, both of which are dominated by technophilic approaches. There is a noticeable growth in laboratories specialising in modern gut microbiome analysis. These labs are specialising in stool tests, offering new methods for estimating the number and type of bacterial populations within the gut, and delivering, as therapeutic interventions, a variety of laboratory-grown bacteria species to be consumed in the form of probiotics or by introducing faecal transplantation for severe incidents. These modern techniques are developed to work around the problematic and ignore the need for long-term healing of microbiome destabilisation. Although many probiotics are known to be beneficial, they need to be well-suited to patients' needs and still may not work for everyone (Logan et al. 2016: 5). Faecal transplantation seems to be a recent successful method, but it still remains in an experimental phase. Since each human-microbes assemblage is different, methods for returning to the state of symbiosis are hard to standardise. Humans are constantly extending and modulating the affordances of their environments, yet many new methods for diagnosis or healing of unbalanced human-microbe assemblages – such as advanced laboratory tests or probiotic therapy – are insufficient or unavailable for many. Therefore, as scientists claim, attempts 'at targeting the human microbiome with purely biotechnical solutions may provide important breakthroughs. However, these are unlikely to meet their true potential if the underlying environmental and lifestyle forces that are driving this

need are not addressed' (Logan et al. 2016: 6). Those seeking help also must watch out for deceptions. Microbiome test companies' reputation has suffered after biotech startup uBiome, which offered at-home tests and was eager to genetically sequence clients' gut microbiomes, turned out to be a big fraud (Knapp 2021). uBiome, besides using manipulative tactics to increase the bills paid by clients, used unethical methods of diagnosis that did not provide sufficient medical insight (Farr 2019).

If looking for solutions for restoring balance within human-microbiome relations is an arduous task, regulating other disrupted microbial arrangements, i.e. those arising in relations between soils, plants, mammals etc., does not seem to be easier in any way. The conclusions drawn from this call for a notion of care that extends beyond our bodies to the exhausted planetary microbiome. I deem it necessary to follow Annemarie Mol's 'logic of care' [9], which highlights the interdependence of life forms by starting out from the fleshiness and fragility of life (Mol 2008: 11). The necessary care in this context would require working on cutting off branches of production, power or knowledge that are spreading individualism, violence and capitalist exploitation. It would mean dealing with recurring numbness or insensitivity towards prevailing aggression, appreciating otherness and putting forward calls for change. As is stated in the description of the Planetary Ecologies discussion group:

> Intersectional, perspectival and non-mainstream viewpoints need to be studied, discussed and acted upon toward more equitable distributions of responsibility, discourse, and directions. It is the responsibility of those who have often overlooked marginalised voices, within and without academia, to do the work of studying, learning and listening. (Van Der Eijk et al. 2022: n.pag.)

This logic gives rise to a practice of embracing malleability, for maintaining, repairing and staying with trouble, and also for dealing with experiences of time that seem to flow more slowly due to a lack of visible improvements in health (Baraitser 2017).

Guattari asserts that the map operates as a temporary moment in between: not a shape of things, but an outline of a process [10] (Mullarkey 2006: 157). In Yates-Doerr's text, medical personnel are documented in the process of doing the difficult work of translating the objectifying, categorising and dividing knowledge pracices of Western medicine into affective, performative, haptic experiences. Practices of healing are based on a plethora of performative actions and various fields of operation. Thus the mapping of human-microbiome intra-actions should also be based on visual, haptic, motion, sound, other sensory expressions, different perceptions and encounters, including quantitative and numerical ones if needed.

These new maps focusing on relationships and care are indispensable for creating a better future than the prevailing scientific scenarios (Erbel 2022). Yet, we have to be aware that the former's completeness will always remain out of reach. Moreover, the previously introduced notion of 'multitudes containing us' indicates not only how uncontrollable the world inside and outside us can be, but also that our maps are created out of these unknown relations and processes. As Joanna Erbel writes, we continue to have a limited but important choice to make, for creating and staying open to a future based on solidarity and collaboration (Erbel 2022: 18–19). Jameson's goal of overcoming modern human disorientation should be turned towards the challenging and unsteady, but vital pleasure of undertaking the mapping of our entanglements embedded within the complexity of everyday local and global intra-actions. Thus this article finishes not with a conclusion, but an opening note targeted at remaking our mental, embodied, entangled maps of daily experiences.

In the title of this article, I propose the term ‘gut buddies’, after researcher Jamie Lorimer (2016). However, Lorimer originally used the term in a slightly different context, referring to parasites, not gut bacteria, used in newly founded curing practices. Personally, I would like to end this elucidation with a friendly note for all who struggle with gut microbiome pathogenic relations. The word ‘buddy’ may be situating the relations with the human gut microbiome in an affiliation that is less about fear and hostility and more about putting trust and hope into this relationship.

ACKNOWLEDGEMENT

This article has a rather ordered, structured form, despite being inspired by a deeply strange, stressful loop of personal unhealthy states. I partly used the words of others to recover my own voice. Moreover, the clarity of the form helped me to map and enclose some issues related to my personal experience. The creation of this field map would not have happened without friends, strangers, academic scholars and editors of the issue – to all of them I am deeply thankful.

ENDNOTES

[1] In a recent article published in *Nature Reviews Microbiology*, the authors pose the need for gaining a better understanding of the soil’s microbial physiology and metabolism. Findings developed from this can be used to improve mathematical climate change models and to recognise the complex relations constituted between the soil microbiome and global warming (Jansson and Hofmockel 2019: 1). As presented in the paper, the soil microbiome plays a crucial role in adjusting climate feedback together with production and consumption of greenhouse gases. However, it is hard to predict which role this specific bacterial arrangement will have in future climate scenarios – either towards acting as a carbon sink or as an increased source of gases such as CO_2 (Jansson and Hofmockel 2019: 1). At the moment, it is assumed that soil microbes increase carbon emissions into the atmosphere, possibly exacerbating global warming trends. The soil, too often underestimated and overlooked, is currently being depleted of its rich and varied composition at a fast rate, which has an impact on whole ecosystems and living creatures.

[2] The concept of ‘local biologies’ is introduced by Margaret Lock (2017: 7) as the ‘biological difference among people that results from bodily responses to differing environments over time and across space’. Lock conducted extensive research about the experience of menopause in women (a comparison was made between Japan and North America), where significant differences appeared as a result of local society and environment, not ethnicity. ‘The notion of local biologies refers to the manner in which biological and social processes are permanently entangled throughout life’, and local biologies’ significance for the wellbeing of the organism increases with time (Lock 2017: 8).

[3] See the webpages of the projects: https://www.hmpdacc.org/ and https://earthmicrobiome.org/

[4] The Forum on Microbial Threats is held by the Health and Medicine Division of the US National Academies of Sciences, Engineering, and Medicine and led by government agencies, academia, non-profit foundations and the private sector.

[5] In his own synthesis of this concept, Jameson was inspired by Kevin Lynch's spatial description of cognitive mapping. Lynch, a behavioural geographer and urban planner, explores mental maps of urban space, together with the ways in which humans orient themselves within and relate to urban spaces (Kusiak 2017: 34). He has developed the concept of 'legibility' of space through his research into urban spaces. Lynch proposes Boston as an example of a legible city, complete with visible monuments and markers, and despite being grand, simple to capture mentally.

[6] As described by Jameson, functional mapping is accompanied by aesthetic gratification, which can be understood as some form of pleasure engendered by perceiving ordered, simple forms. Therefore, Lynch's city example – Boston – not only allows 'people to have, in their imaginations, a generally successful and continuous sense of location in relation to the rest of the city, but in addition gives them something of the freedom and aesthetic gratification of traditional city form' (Jameson, 1988: 350). Hence, successful urban mapping is seen as providing various psychosomatic and mental health benefits.

[7] The Western medical practices described in Yates-Doeer's stories use numerical representations of the body such as weight, height and Body Mass Index (BMI). Nutritionists officially follow a structure and hierarchy typical of Western medicine based on a division between the responsibilities of nutritionists and doctors. This space is also deeply gendered – almost all nutritionists are women. Furthermore, the medical infrastructure is spatially separated from other services, and nutritionists have limited interaction with doctors.

[8] In her book *Numbered Lives: Life and Death in Quantum Media* Jacquline Wernimont (2018:1) asks crucial questions about 'what does it mean to be or become with media?' and about how people create themselves through relationships with the technologies they produce. Among other things, she shares knowledge about histories of death counts conducted in modern European states and later used in the slave trade. These death counts turn out to be part of broader social transformations in which quantum media become popularised and used in many fields – also in medical practice.

[9] The idea of a 'logic of care' is articulated by Annemarie Mol in her book *The Logic of Care: Health and the Problem of Patient Choice*. Mol describes the different attitudes of those who work closely with the treatment of diabetes, varied medical personnel and the operations of the medical market itself and its representatives. Here appear different logics of operation – the logic of choice, the logic of the market and the logic of care. In her definition of the logic of care, Mol (2008: 12) underlines the importance of patients' environments and the society they live in. 'We do not start out as individuals, but always belong to collectives already – and not just a single one, but a lot of them'.

[10] 'Make a map not a tracing' is a famous statement by Deleuze and Guattari pointing to the difference between a tracing – a reproduction of what is already known, and a map – an act which does not reproduce the previous traces, but constructs new ones (Deleuze and Guattari 1987: 12–13; Corner 1999: 211). A map is always about performance (Deleuze and Guattari 1987: 12).

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About the author

Elżbieta Kowalska is a researcher, designer and artist based in Poland. She holds a BA from the University of Fine Arts in Poznań and an MA in Interactive Media and Performance from the Institute of Theater and New Media at Adam Mickiewicz University. Her research examines the intersections between coded spaces, visual language, art, design and politics. In her practice Elżbieta works with feminist, critical and anti-colonial methodologies seeking to understand how technologies such as geographic information systems and digital mapping are imagined, constructed and operated, and how they influence the world and social imaginations. Furthermore, Elżbieta leads theory and practice-based workshops for students and non-governmental organisations. She is the co-author and co-creator of art and science projects exhibited at the student pavilion at the Prague Quadrennial 2019 (Czech Republic), WRO Art Biennale (Wrocław), Conference of the Parties (COP24, Katowice) and Malta Festival (Poznań). Elżbieta has published in Polish scientific journals, such as *Widok. Theories and Practices of Visual Culture* and *Contributions to Humanities/Humanistic Studies AGH*.