

# The Un/natural Symbionts.

## Kombucha-making as social-epistemic practice

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### Abstract

How knowledge can be adapted, exchanged, and transferred in between disciplines, is an open question in art-science. The project Unnatural Symbionts explores through rituals how knowledge from several disciplines and fields on micro-organisms can be made palpable in one space. Using kombucha fermentation as field for exploration, the various relations of microbes and humans in scientific and non-scientific discourses are discussed. Microbial life is understood in its other-than-human agency and its role in our human identities which becomes connected to personal memories of making food and drinking tea. The goal is a curatorial practice that invites artists, scientist as well as a wider audience to reflect on concepts of symbiosis from the perspectives of lived experience and multispecies rituals. Microbiological research on microbial diversity is questioned in its meaning for self and individuality as philosophical concepts. The kombucha-making as a process becomes a method to experience microbial life with the naked human eye. The ritual binds these elements together to create a socio-cultural practice that avoids being bound to traditional conventions and creates a space for new ones.

### Keywords

Art-science, philosophy of science, social epistemology, symbiosis, multispecies, curatorial practice, ritual, lived experience.

### Introduction

When we discuss interdisciplinary knowledge, a common concept for its definition is integration [1]. But knowledge exchange or synthesis is not necessarily goal in art-science research. More importantly, sometimes an assumption thereof can be counterproductive for the goal of adapting, translating, and sharing knowledge across the disciplinary boundaries of artistic and scientific research. For a broad interdisciplinary field such as art-science, the knowledge, methods, and tools between collaborators do not necessarily connect seamlessly. The process can be more complex, or even a “creative conflict” [2]. One assumption of my research was that diverging perspectives between disciplinary boundaries or artistic, scientific, and nonscientific standpoints can lead to unconventional and creative

interdisciplinary methods. Instead of seeking a common ground, conflicting perspectives can be a source of inspiration.

My research on the concept of “Un/natural Symbionts” began with this question of connectedness and non-connectedness of disciplinary knowledge systems. The concept of symbiosis was created in microbiology and travelled to philosophy of science, anthropology, and cultural studies. Researchers investigate symbiosis as the co-habitation of environments human and other-than-human micro-organisms. The fields regard this co-habitation from its biological, genetic, social, and cultural dimensions. Our understandings of what symbiosis with microbes means, can vary based on disciplinary perspectives, lived experiences, or other social and cultural aspects. Research in the arts and the sciences is always social as well as epistemic. Regarding micro-organisms, the social and cultural dimension of our knowledges about these other-than-human beings is particularly influential. Microbes play an integral role for our food, our bodies and even our DNA. A main question for my research was how all the many diverging knowledge and knowledge systems about microbial life could be connected and whether any conflict may arise when trying to do so.

By introducing kombucha-making and scoby as a ritual in my research, the demarcation lines between scientific and non-scientific knowledge become blurry. Kombucha, like other fermented foods, carries deep social and cultural meanings for our concepts of home and cultural heritage in addition to our understanding of its scientific principles [3]. The question is whether by making the boundaries of knowledge about microbes palpable and understanding their relatedness, we can create more public awareness of our complex communities with microbial life. The aim is not to ground an awareness fully in the sciences and neither in a poetic reinterpretation thereof. The ambiguity of the intra-relatedness is central, and the meanings of our other-than-human communities remain open and fluid. It is about investigating playfully how the different ways of knowing about our microbial symbionts are connected. The diverging knowledge systems about microbes are made palpable and visible and become a source for open discussion.

Concepts such as symbiosis and symbiogenesis as described in biology have been adapted and translated in philosophy of science and cultural studies [4]. Our co-existence with micro-organisms such as fungi and bacteria as other-than-human are discussed as community and forms of co-

habitation [5,6]. Building on the idea of human and other-than-human communities, “Un/natural Symbionts” centers on social rituals as a methodology to explore the meanings of such communities for our senses of self and identity. To do so, artistic and curatorial methods are combined with scientific knowledge and DIY methods.

## Microbial Agency in Science and Culture

In our gut, in soil, in water and almost any other surface and substance on this planet, microbial communities exist and make possible the larger forms of life with which they co-inhabit these environments. The communities can be symbiotic or commensal for their communities and they can be pathogenic. In the history of microbiology, microbes have been regarded from numerous anthropocentric perspectives. Micro-organisms share our environments with us. They are essential for our health and wellbeing, and they can be the cause for illnesses.

In the past, micro-biological research has centered mainly on the threat bacteria pose to humans whereas nowadays, the microbial diversity is acknowledged and their vital impact on life on earth is understood [7]. Microbes are a part of ourselves which includes our DNA and even our sense of self [8]. The general shift in perspective in microbiology from hazard to microbial diversity has led scientists to describe our planet as microbial first and foremost. It became possible through DNA sequencing and AI computing and has been a leading research direction in the past 20 years at least [9].

The awareness of microbial life in fermentation began with Louis Pasteur’s investigations in the mid-1800s. Earlier in the modern sciences, fermentation was believed to be a process of spontaneous generation based on a purely chemical mechanism [10]. As a biochemical process, we now understand fermentation as a chain of chemical reactions where bacteria convert glucose and other sugars for cellular energy. From a more environmental and less reductivist perspective, it is also a source for microbial interactions and a vital contribution to its community. As such, we can interpret it as a form of co-agency.

In his essay on Pasteur’s discovery of lactic-acid fermentation, Bruno Latour discussed the transformation process that yeast underwent during Pasteur’s experiments, and particularly in his narrative thereof in the publication of his research results [11]. In his research process, Pasteur transformed the ontological status of yeast bacteria into a living entity as Latour describes: “Here it is no longer the human who transports information through the transformation but the nonhuman as well, surreptitiously changing from barely existing attributes into a full-blown substance.” [12].

What Latour writes about is the transformation of the scientist’s perspective on other-than-human life from an unprompted reaction towards agency. The chemical reaction and experiment in the lab cannot be fully controlled or directed by the scientist but depends on the agency of the yeast bacteria. During Kombucha fermentation, this agency can

be observed when the smell of the tea changes over the days and a bacteria and yeast culture forms.

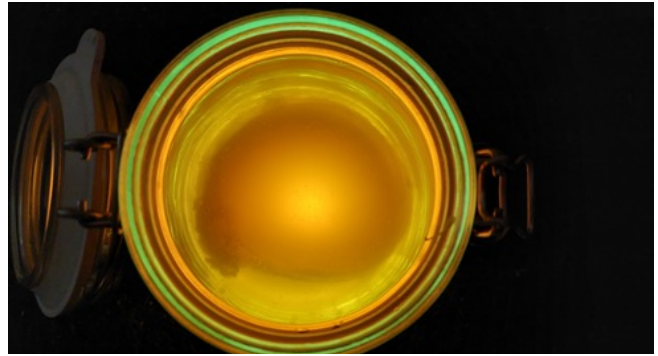


Figure 1. Kombucha Starter Culture with SCOBY in the middle. ©Janina Hoth.

Fermentation is a palpable and visible sign of microbial life. During the process of turning tea into kombucha, a symbiotic culture of bacteria and yeast forms (SCOBY). Usually, the scoby swims on the surface of the drink, slowly growing over days, and showing the living entities at work [Fig. 1]. A ritual of tea-making as a practice to bring together microbial knowledge while also being able to watch the bacteria grow and change was the initial inspiration. Our intricate and intimate relationship to microscopic life is indicated through the microbial materiality itself.

The scoby is a strange by-product of fermentation from a consumerist perspective. It is a part of the double fermentation process of kombucha, which means that a starter culture of already fermented kombucha and a scoby is used to start the next kombucha-making process. The scoby is not a part of the drink to be consumed (the resilient and stretchable texture of its cellulose material would be difficult to eat). It is slimy and sticky when taken out of the kombucha. When dried, it turns into a stretchy texture which artists have tried to use as sustainable material, e.g., as vegan leather [13]. But as a material, it remains resilient to any usage beyond its own agency and it is not suitable for clothing. As Bobadillo/Guzman pointed out, the processes necessary to turn scoby into a sustainable material for design or clothes-making defy the original concept of sustainability [14].

The scoby’s materiality is sometimes associated with disgust or repulsion [Fig. 2] due to its strong sweet and sour smell and sticky texture. For a kombucha-making ritual, I considered this materiality as part of its agency. It was connected to feelings of disgust many people have in general towards bacterial life due to its perspective as a health hazard (more than microbial diversity). The messiness and resistance of its materiality is a part of our co-existence as symbiotic but also pathogenic co-agents.



Figure 2. Kombucha scoby during drying process. ©Hoth.

## Symbiotic Relatedness of Humans and Microbes

Micro-organic life has influenced food cultures and cultural heritage around the world. Fermentation in milk products (yoghurt, kefir, airag), alcohol (wine, beer, pulque) or vegetables (kimchi, sauerkraut) show how widespread it is. Humans have a strong preference for the sweet and sour tastes of fermented food [15].

It takes days to weeks and months to ferment food and has been a carefully curated interplay between microbial communities and human labor for millennia. Fermentation is in this sense related to concepts of labor, particularly female labor, of home, culture, and heritage [16]. In rituals, fermented food is often consumed during communal events. The intra-relatedness of human and bacterial life as symbiotic and commensal is in the center of making kombucha.

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But it goes much deeper than what we eat. Bacteria are an essential part of what many consider to be the core of being human [17]. Our guts consist of a microbial community of their own. Our mental and physical well-being can be heavily influenced by this community. What a person considers to be their self is not only determined by concepts of nature (as in DNA) and nurture but also by the microbes living in our bodies [18].

In the 1960s, scientist Lynn Margulis formulated the endosymbiosis theory out of the symbiotic relationships between humans and micro-organisms [19]. The mitochondrial DNA in our cells was created in a symbiotic merge of bacterial cells with human cells. Our bodies and our existence could not have evolved in this way without this symbiogenesis. For Margulis and many other scientists, symbiosis is central to evolution of life on earth [20]. In her book

*Symbiotic Planet*, Margulis discusses how the theory of bacterial life as fundamental for evolution has existed since the 19<sup>th</sup> century but always remained on the margin of scientific research. She argues that the dominant theories such as Georg Mendel's theory of DNA existing only in the cell nucleus was widely accepted because it fitted into common conceptions of individuality and subjectivity at the time [21].

In other animals, their existence as symbiotic beings is more visible. The Roscoff worm, according to Wikipedia also known as mint-sauce worm or shilly-shally worm, has a natural symbiont with an algae plant. This merge causes the green color of the worm-plant. The algae live entirely inside of the worm which makes it difficult to distinguish between the two species. The algae produce the food the worm eats, and the algae turns some of the worm's waste into nutrients for itself. Their symbiosis is so intimate that scientists find it hard to tell where the worm begins, and the algae ends [22].

On the one hand, our relationships to microbes can be described as a symbiotic community, and on the other hand, these communities can challenge our sense of identity. Like the materiality of kombucha scoby, the relatedness is complex and in-between closeness and repulsion. By combining the knowledge dimensions, these emotional layers are slowly unfolded and become tangible and unstable.

## An Intimate Merge of Knowledges

According to the philosophers Boon/van Baalen, bringing knowledge together interdisciplinarily is always determined by its heterogeneity [22]. Knowledge is not like puzzle pieces that are meant to be connected. Rather, we must imagine it as heterogenous entities which need to be adjusted. Interdisciplinary knowledge is therefore constructed based on the issue researchers are trying to solve. The heterogeneity in this art-science research is not guided by a specific research goal and therefore not united towards one goal. If there is a specific goal, it is to make the heterogeneity visible.

One central question for my research was how artistic and scientific methods are connected and how they are non-connected. Trying to avoid binary thinking, the different perspectives of knowing about fermentation and microbes are not understood as integrally belonging together and they are not regarded as oppositional either. The goal is to create a space where they can be seen simultaneously, which can also create conflict. The focus is more on the process itself rather than a final product. The making of kombucha as a ritual is crucial for the exploration rather than the results of the fermentation. The confrontation of knowledge systems becomes palpable instead of a potential unification thereof.

The ritual of tea ceremonies is explored in intra-relation to the biochemical process of fermentation and its adjacent concepts of home and cultural heritage. Since kombucha is a double fermentation, and therefore a process which builds on and changes with each new tea, I connected the idea of a starter culture with cultural traditions and personal memories.

My kombucha cultures are made of tea that are connected to my own lived experience. They come from places where I have lived: East Frisian tea, strawberry black tea from Denmark, Oolong tea from Hong Kong. To make the tea for the kombucha mixture, I would prepare it in the traditional way as instructed by their significance as national cultural heritage. While Oolong and Frisian tea have a prescribed ritual, the strawberry tea comes with no expectations since there is no official national Danish tea culture. It was therefore prepared as instructed by the packaging. The first aspect of a kombucha-making ritual is the connection between foods, concepts of home and cultural heritage.

The smell and taste were written down together with the scientific imagery as well as personal memories. Then, the kombucha culture is added to the tea and the process begins. The starter culture therefore represents the microbial community inside as well as the blending of tea with its relatedness to my lived experience. The approach focuses on a hyper-micro perspective regarding (1) the personal memory of the human participants, (2) the intimate and symbiotic relationship between human and other-than-human agency and (3) a ritual as a micro-event which emerges in the space of the kombucha-making and dissipates when the kombucha is finished/ ready to be consumed.

By creating a new ritual through kombucha-making, any participant can share their own lived experiences and memories. The ritual is created as a space for juxtaposition: lived experience, memories, ceremonies, scientific imagery, microbial co-agency, microbiology are all made visible and palpable to explore connections and non-connections. The ritual is less concerned with heritage on a national or even local scale, but in creating hyper-micro narratives based on the lived experience of myself and other participants with each ceremony.



Figures 3-5. Chemical composition of lactic acid; experiments with scientific and cultural signifiers. ©Hoth.

### Conclusions: The Ambiguity of Co-agency and Knowledge

The kombucha-making explored the intra-relations of our knowledge about microbes biologically, chemically, culturally, and socially. It did not presuppose a harmonious relationship between human and other-than-human communities or between scientific and non-scientific knowledge and welcomed conflict as a source for creativity.

Beginning with the scientific knowledge, the concept of symbiosis is applied for a slow transformation towards cultural narratives. I begin with the chemical compositions of

kombucha fermentation. Using it as a graphic element, I strip away the scientific denominators, leaving a pattern that is ambivalent in its reminiscence of a scientific model and a cultural sign. The goal is not to create a poetic imagination of microbiological signs but to make a symbiotic, or amphibious as well as intimate merge of the two knowledge systems. Both systems should remain visible [Fig. 3-5].

A second result from the artistic-curatorial perspective were experiments with the uncanny relation towards microbes. The paradigm of a health hazard in the sciences in connection to concepts of home and ritual made me experiment with a kombucha scoby as a symbiont. The materiality of the scoby shows the ambiguity inherent to our scientific knowledge of microbes as something inherently a part of ourselves and our environment while a (potential) source of hazard and discomfort at the same time. From a personal-social perspective, an ambiguity between self-identity, its embeddedness into human and non-human cultures, or naturecultures, becomes palpable. The unnatural symbionts go beyond symbiosis in a harmonious understanding but that pushes and pulls at human concepts of identity, individuality and human relationship with “nature” as other.

In the curatorial explorations, shiny and sparkly party supplies were added to the scoby before drying it. Although a natural material, the sticky and stretchy quality of the scoby fills many people with disgust. The scoby was then juxtaposed with the unnatural and often unhealthy materials used in party supplies which many people have come to associate with parties and rituals [Fig. 6]. They represent how we have created rituals such as celebrating birthdays as clean, sparkly, and somewhat controlled events.

The unnatural symbionts create a feeling of uncanniness—familiar and unfamiliar at the same time—which conceptually shows how we often consider microbial life as something dangerous and foreign while it is a part of our very self. The connection artificial/natural as “unnatural symbionts” is a method to critically reflect on the meaning of rituals from a consumerist or nationalist perspective versus the lived experience of our micro-verses.



Figure 6. Dried scoby in champagne glass with sticker. ©Hoth.

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