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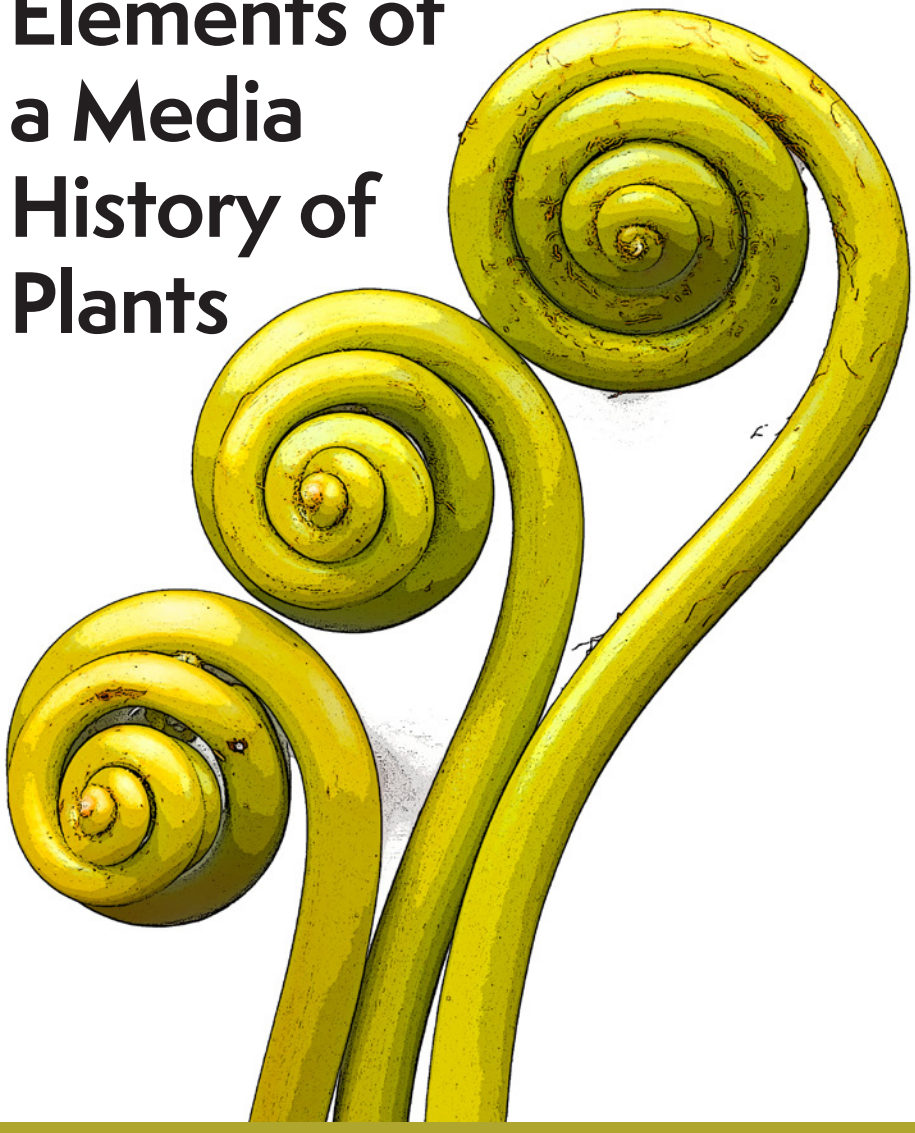
Becoming Media: Elements of a Media History of Plants



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ABSTRACT

Plants communicate with their fellow species, but also with other species. The communication of humans with plants, in turn, represents an old phantasm that is intended to lead to contact with the seemingly mute creatures. This article revisits the history of plant cognition from a media theory perspective. The article questions the extent to which media and electricity have historically been and are currently *leitmotifs* for entering into resonance with plants. The focus is on media-historical and science-historical approaches that have conferred to plants the ability to communicate and on current sensor interfaces through which plants are turned into sound in media art. The article argues that, whenever media technology makes plants 'speak', what the human listener actually hears is the medium, not the plant, because it is a human construct.

KEYWORDS

media theory, information theory, plant cognition, sonification, communication, media art, listening.

This article investigates the resonance relationships between humans and plants. It draws on sociologist Hartmut Rosa who presented the concept of resonance in 2016, in a time during which detachment and alienation from the environment are often felt. In this context, resonance refers to 'being in touch' or 'tuning in' to a counterpart. Resonance is the promise of a 'deep' connection that not only evokes rational understanding but also touches the heart and the body. In relation to plant life, the question arises as to how a mutual understanding in the form of resonance between two very different realms of living beings is possible. If the understanding is based on a romanticised definition of nature, it would mean that humans might be instrumentalising plants for their own resonant imaginary. If it takes the form of communication known to information theory – the mathematical study of the quantification, storage and communication of information – a broad concept of language independent of human speech is needed. In the following, I will advance the topic of plant communication through references to media theory, the history of science and media art towards the direction of plants becoming media. This will allow me to discuss the extent to

which resonance relationships belong to people's longing for immediacy and connectedness and also to identify when these longings for resonance ultimately come to nothing. There will be a shift in the meaning of the term 'resonance', which I will also use in its physical dimension. Resonance, as I see it in play with plants, is an electrical connection through oscillation. It is only through the human imagination and its capacity for empathy that this can be felt as resonance in Rosa's sense. Whenever media technology makes plants 'speak', what the human listener actually hears is the medium, not the plant.

PLANTS IN NETWORKS

Several years ago, roughly 70,000 trees in Melbourne, Australia, were each assigned an email address so that people could write to the individual trees about how they observe and perceive a particular tree (LaFrance 2015). In Europe, as part of a recent initiative called *TreeWatchNet*, a number of trees were linked up via sensors that enabled them to transmit data on their growth and sap flow via WiFi, but also to 'tweet' with the assistance of an interpreter (Schneider 2018). The tweeting trees in the TreeWatch network speak English and in full sentences saying things like the following:

> 'I am a Scots pine (Ø = 26.1 cm) in Germany (Britz) in a forest of the Thünen Institute of Forest Ecosystems.'
> 'My sap has started flowing!' 26 May: 'Today I have grown 0.037 mm, transported 2.7 L of water at a maximum speed of 0.3 L/h.'
> 'My sap is stopping to flow for today. The maximum speed was 0.2 L/h.' 28 May: 'During this warm day (max 26.7°) I lost 114 L of water and my max sap flow was 9.4 L/h – tough day.'

While it has always been completely normal for trees to 'talk' in the world of fables and fairy tales, it appears today just as normal for plants as for humans to be digitally linked and in regular communication with each other. However, these talking trees in our digital era of global communication do not become part of some kind of Internet of (lifeless) Things. Instead, they are prompted to speak as active members of a social media ecosystem. The secret life of trees or the language of plants – both are book titles that (again) attract large readerships in the world today.

Before situating the study of plant communication in its historical context, I would like to introduce a thought that allows us to very clearly frame the question of how we might possibly communicate with plants – that is, by approaching the subject from the perspective of xenolinguistics (Vakoch 2024). Indeed, questions such as 'How might we speak to an alien?' and 'What might an alien language sound like?' can be directly applied to the subject of plant communication. When we think of the types of communicative exchanges that are capable of transcending the boundaries between species and entities – for example, as thematised most impressively in the 2015 film *Arrival* – it becomes clear that, at least in a very reduced form, a language only needs two properties, namely a channel and a sign transmitted via that channel. Speculations as to how we might be able to communicate with extraterrestrials often continue in this vein – i.e., extraterrestrial languages don't necessarily have to be audible or based on alphabetical or logo-graphic elements; they can just as easily also consist of the transmission of light or chemicals.

The model of communication associated with the information theory of Claude Shannon and Harry Nyquist developed in the 1920s and 1940s used electrical telegraphy as model. When an electrical line is free of interference, two people or technical systems can send and receive messages, provided they know the codes.

Today, it is considered scientific fact that plants are able to orient themselves in their environments in many different ways. Research has shown, especially in recent years, that plants communicate via numerous channels in a chemical, olfactory, electrical and optical manner, not only with other plants, but also with other living creatures, such as insects, birds, mice and fungi (Baluška et al. 2006).

If plants communicate, the question arises as to which concepts and terms we should use to describe plant behaviour. This discussion follows debates surrounding the definitions of 'intelligence', 'consciousness', 'memory', 'will' and 'decision' in the fields of biology and plant physiology, while many plant researchers favour less loaded vocabulary such as plant sensitivity or plant awareness (Trewavas 2003, Chamowitz 2012). The question here is whether these concepts are understood narrowly – i.e. zoo- or even anthropocentrically – or independently of the nerve networks as an abstract principle of cognition, as the philosopher Michael Marder (2013) has developed with the term 'extended plant

cognition' in his seminal book *Plant-Thinking. A Philosophy of Vegetal Life,* rejecting the disputed term 'plant intelligence'.

The model of technical communication devised by Shannon and Nyquist is so universal that biologists were able to apply it to their own fields of research. For example, biology uses the term 'communication' to describe the internal '(sign-mediated or signal) interactions' within the plant as well as with other organisms.

The founding tome of *Cybernetics*, published by Norbert Wiener in 1948, also contains a universal model of communication that explicitly includes all living creatures, even though the book is titled *Cybernetics: Or Control and Communication in the Animal and the Machine*. Indeed, Wiener's information theory encompasses the ability to receive and organise impulses as a 'fundamental property of living matter' (Wiener 1985: 124). As we know, the descriptive language of cybernetics applies not only to machines but also to living organisms. Wiener primarily uses his theory to define animals and technical sensor systems as 'sense organs' (e.g. 'hydrogenion-potential recorders, which may be said to taste', Wiener 1985: 42), which he considers equivalent to the nervous system. At the same time, he ultimately concludes that all these processes 'lend themselves very well to description in physiological terms' (Ibid., 43). Through this perspective, one could expand the realm of cybernetics to the biology of plants as well. This had two effects. Within biology, it helped to successfully explore and describe the ways in which plants process many different kinds of signals. At the same time, it led to technical media settings that were detached from science and more oriented towards popular discourse, based on the claimed possibility of establishing a direct interface for plant-human communication.

In what follows, I will touch on the history of media-shaped imaginations and research on plant communication that for decades that placed a kind of *electrical apriorism* on that research. 'Resonance', in this context, is an effect of electromagnetic waves. This approach was rooted in a particular understanding of electrically conductive channels and their translation into electromagnetic curves. In other words, we must recognise and acknowledge the inherent electrical bias within the communication analyses and models from the twentieth century, which can be referred to as an *electrical a priori*. This bias becomes particularly evident in the pseudo-scientific plant experiments of the 1960s and 1970s, most of which were carried out based on motives from the fields of

control engineering and communication technology. In the context of these experiments, several US engineers connected plants to electrodes and galvanometers, not so much with the intention of establishing a connection with nature, but rather to utilise plants as conduits for the reception of human thoughts and emotions. The pseudo-scientific experiments of Cleve Backster, a lie detector specialist, who was later seen as highly problematic for the public relations of plant cognition research, were very influential for the public notion of plant communication. His work represents the great public fascination with plant-human-communication through technical media devices, which remains true in our own times of increasing ecosystem loss. An example is the advent of devices such as 'Plantwave', an app that sonifies surface tension data taken through sensors from different (mostly potted) plants around the world and translates the data to ambient music via the app. Users of the app can tune into different plant data as if to a plant radio station. Starting with examples from art, I will interrogate bio-sonification in general. Then I will briefly outline the historical context in which the early experiments took place and summarise current findings in plant research that are important to understanding the limits of media-technological approaches to interacting with plants.

THE PLANT AS MEDIUM IN ART

Today, there are countless works of art drawing on the idea of plant communication, many falling into the category of 'BioArt'. Following calls for a perspective that de-centres humankind in favour of something more-than-human, a number of artists are using bio-signals, especially the visualisation and sonification of signals, as a way of making it possible for us to experience the 'language of plants'. Most of these works of art prove the success of the 'Backster effect', as I will call a typical media-technological set-up after the most notorious and popular experimenter in the 1960s and 1970s. One by one, electrodes are attached to a potted plant, registering voltage fluctuations in their leaves or roots triggered by the activities of the plants themselves. The dynamic activity pattern of the plant controls the pattern of the acoustic signals.

There are many works by artists who have been experimenting with this type of basic plant-media over the past decades. An early work

of interactive media art under the title *Interactive Plant Growing* by Christa Sommerer and Laurent Mignonneau from 1993 encourages participants to control the mathematical generation of artificial plants on a video screen by means of touching potted plants. As museum visitors stroke five real tropical plants in their pots standing on pedestals, they witness the effect of their manual interaction in growing green tropical plants on a large video screen. The room is extremely dark, as is the background of the bright green generated plants on the screen, which seem to be growing in a jungle at night. At the same time, the dark environment is very unnatural for the plants and the question arises as to how long the plants will survive under these conditions. The viewer's attention is focussed on the feeling in their hands and the sight of the rapidly growing plants on a canvas filling up with leaf structures before their eyes.

Musician Miya Masaoka employed potted philodendrons connected to electrodes for her composition *Pieces for Plants* (2000–2012). By connecting the plants to her computer, the set-up allowed her to play the philodendrons as if they were a theremin. In her performances, the artist can be seen sitting on a floor amidst a multitude of cables, gesticulating with her hands over the plants in sweeping movements, while synthesiser buzzing noises can be heard. She regards this set-up as a way to give 'voice' to the plants, their electrical activity and their physiological response to its surroundings, as she says on her website (http://miyamasaoka.com). The title *Pieces for Plants* seems to promise that the plants will be able to perceive the music. This could mean that the plants perceive the live music and the activities of the musician at the same time and change their electrical activity as a result, which would be a typical feedback situation.

A comparable approach is taken in the work *Acousmaflore* (2007) by the group of artists known as Scenocosme; museum visitors are invited to change the electrostatics of dozens of commercially available plants like *Epipremnum aureum* (money plant) hanging from the ceiling in pots. By touching them with their hands they produce different minimalist and synthetic sound patterns. The sound is reminiscent of pearly patterns of small bells. The three examples have in common the role given to human interaction. A plant-human-machine interface is the condition under which aesthetic experiences become possible. Whether it is the plant that the recipients or 'users' hear and see here is, however,

questionable. It almost seems as if they are reaching into the void in their longing for a heartfelt connection with plants.

Today, such plant-media assemblages not only exist in museums, but also in commercialised form. Today, at *Plantwave*, the company of the app that was already mentioned, one can purchase a small device that converts the electrical intensities of the plants in real time in a non-stop stream of sparkling melodies and rhythms, ultimately promising to 'tune into nature through plant music' (plantwave.com). Resonance in these media assemblages is made possible by connecting the surfaces of the leaves and transferring their changing tension in relation to humidity either analogue or digitally to a technical interface that transforms them into sound. The sonic result is influenced by the artist's choices and the functionality of the medium.

Sonifying plants is not a new approach. In fact, the possibility of aesthetically translating the 'Backster effect' from waves into sounds had already been explored by the media artists in the 1970s in the US, as both media scholars Teresa Castro (2019, 2020) and Verena Kuni (2020) have pointed out. The experimental musicians and artists John Lifton, Tom Zahuranec, Jim Wiseman and Richard Lowenberg used plants' electrical signals to produce video and audio sequences. This group of artists combined plant signals with signals coming from their own electric activity measurements based on their brain and muscles. To achieve this convergence, they connected their bodies to the cutting-edge medical diagnostics tools of electromyography (EMG) and electroencephalography (EEG) (Kuni 2020: 18). The performance took place in 1976 over the course of four days at the Conservatory of Flowers in San Francisco's Golden Gate Park.

Watching the video of the performance today, it seems to resonate very successfully. The interconnectedness of people and plants suggested by the work was expressed particularly in the bodies of the performers. A woman stood holding a sensor in her hands, with her eyes closed, as two female dancers performed an expressive dance made up of convulsive movements, moving to the sounds and among the plants. Here we see the extent to which these electronic experiments were embedded in a context which, rather than focussing on increasing mechanisation, sought to explore the potential of spiritual experiences by means of hypnosis, trance and psychoactive substances. It also sought to engage in a 'new-age yearning for wholeness' and against 'the decay of a successful

relationship to nature caused by modernity', as noted by Stefan Rieger and Benjamin Bühler (2009: 61).

It seems that these approaches are relevant again today because the approaches of the different media artistic pieces relate well to the current calls for decentred, more-than-human perspectives. The resonance that can be observed in response to the artworks shows much about the expectations of technical media, which reveal hidden worlds by making them perceptible. At the same time, the question arises as to whether the output of such connections is a possibility of experiencing resonances with a plant at all, or rather only with the technical medium. Maybe the answer lies in the 'ear of the beholder'. If the resonance is only in relation to the technical medium, then the experience might actually be another form of 'hungry listening' or 'listening for'. Dylon Robinson used this term to name a colonising, differentiating, standardising and consuming mode of listening, in contrast to a listening in relation, a 'thinking-feeling' of 'listening with three ears' (Robinson 2022: 50, 51). Approaches that appear to enable new perceptions in order to transcend the nature-culture divide must be viewed critically. This is because they always threaten to focus on the latest technical media and thus distract from a new perception of nature.

CURRENT INSIGHTS IN THE FIELD OF PLANT PHYSIOLOGY

When using sensor technology and electrical circuitry to sonify plant responses, it is important to contrast this with what is currently known about how plants communicate and sense their environment. Recent progress in the field of plant physiology has compelled us to formulate a fresh perspective on plants (*Pflanzenbild*), a refined rendition of our conception of humanity (*Menschenbild*). Indeed, the last three decades have seen paradigm-shifting discoveries that would certainly fulfil the criteria of a scientific revolution as defined by Thomas Kuhn because they have proven the assessment of plants as more or less passive living beings without the ability to perceive their environment to be a misjudgement.

Plants do not have nervous systems, which is why they must process sensory perceptions in other ways. Internal plant communication takes place via the vascular system, which uses electrical but also hydraulic

and chemical signals for the various plant systems, for example, from the roots to the leaves via vascular systems. Electrical signals close the stomata of the leaves when there is too much sun; electrical impulses activate plant movements, such as the closing of blossoms and leaves, including the jerky contraction of mimosa leaves.

Plant physiology describes the numerous organs plants use to perceive the world, whereby it is assumed that there are at least fifteen senses for plants. Here, the focus is less on sensitivity to light and the ability of roots to find particularly nutrient-rich areas of soil; instead it is primarily on the cells located on the surface of plants from which they gain 'information about their environment … and communicate with each other' (Mancuso and Viola 2015: 56). The so-called stomata are usually found on the underside of leaves and act as odour receptors via molecules called BVOC (biogenic volatile organic compounds). There are over 8,000 known terpenes and over 30,000 of the closely related terpenoids. These chemical signals can be used to communicate dangers, such as pest infestations, but also to send out attractants to friends and foes. This occurs, for example, when flowers use their scent to attract pollinators tuned precisely to seek out these odours. When under attack, plants inform neighbouring plants – but also flora located further away – about the approaching danger via scent signals through the air. This allows their fellow plants to arm themselves defensively by releasing bitter enzymes that render their leaves inedible and/or poisonous within a very short time, as is the case of the umbrella acacia, the lupine and tomato plants. In the same vein, trees can tell by the saliva of insects whether they are harmful to them or not – and subsequently take the appropriate precautions.

The air and wind are not the only channels that serve as key routes for plant communication. Recent research in the realm of forest ecology, and especially the work of Suzanne Simard, has shown that roots in the soil also function as conduits for plant communication. For example, a single pine tree can be linked to hundreds of trees of different species via symbiosis with the subliminal network of fungi and mycorrhizae. This network serves the purpose of providing mutual nourishment, but also the equally important exchange of those abovementioned biochemical signals – i.e., terpenes and BVOC molecules – which are crucial in warding off tree species that have been classified as intruders and to warn of some impending danger. Trees are also able to recognise the

degree to which they are related to their neighbours, and this allows them to provide particularly well for their own offspring.

The final realm of bio-communication is one we've known about the longest, largely due to the fascinating forms of mimicry involved. Most plants require animals to be able to reproduce. This means that clear and unambiguous communication is an essential element to the survival of all those plants that produce offspring solely by means of allogamy (*álios*, meaning foreign, and *gámos*, meaning union). The result is the emergence of a veritable 'flag alphabet', precisely adapted and coordinated by plants to communicate with the couriers of their fertilisation such as insects (entomophilous), birds (ornithophilous) and bats, hummingbirds, primates and reptilies (chiropterophilous). For example, the Cuban climbing plant *Marcgravia evenia* produces blossoms in the shape of satellite dishes so that they can be heard by their pollinators, i.e., bats, via echolocation. In contrast, other plants send out targeted misinformation as a way of attracting their pollinators. Orchids, for instance, are known for the masterful mimicry they use to attract their pollinators whereby these signals are categorised as either 'deceptive' (e.g., orchids) or 'honest' (e.g., the lupine, which turns blue after pollination).

At this point, it is necessary to call attention to the fact that traditional aesthetics are organised according to the five human senses. Anyone who chooses to address the *aisthesis* of plants, however, will soon understand that these five human senses are inhibiting factors when it comes to recognising and imagining non-human forms of cognition.

PLANT COMMUNICATION WITH PEOPLE AND MACHINES

Plants do communicate, but they do so through distinct codes and channels. They establish connections not only within their own biological processes but also with other forms of life. Plant researchers are therefore obliged to point out, time and again, the extent to which the conception of plants that has prevailed in the Western world since antiquity serves to block new ideas from forming, even in the face of inexplicable observations.

Turning to the scientific history of plant research, Darwin's initial observations of perplexing plant behaviours, which he described in detail in his books from the 1870s and 1880s, underwent further examination

(Darwin 1875, 1880). The exploration leveraged new methods from psychological research – specifically, the integration of chart recorders. These methods, referred to by Etienne Jules Marey (1878) as 'the language of the phenomena themselves' (III), unveiled a new dimension of understanding. The realisation that such a language of phenomena could also be elicited from plants through electrical means wasn't brought forward by a Western researcher. Jagadish Chandra Bose**,** an Indian natural scientist (1858–1937), spearheaded extensive research on the electric response of plants towards the close of the nineteenth century. Employing self-made instruments in his laboratory, Bose delved into the intricate relationship between plants and electricity. He was the first to establish the responses of plant cells to electric stimuli as well as the conductivity of signals, and he published widely on the subject. However, as plants were considered to be purely chemical and mechanical things back then, his research left many people unconvinced. The fact that plant cells do possess electrical conductivity was only ultimately proven in the 1990s (Wildon et al. 1992: 62–65).

Bose's plant experiments didn't make him famous in Europe or the US back then. Instead, it was in the 1970s that an electrical engineer, Cleve Backster, gained fame there – especially through a very popular book. The early research into plants using tools associated with electrical engineering as well as the experiments undertaken in the 1960s were described in *The Secret Life of Plants*, a highly popular book published by Peter Tompkins and Christopher Bird in 1973. The book also promoted Bose's research as a pioneer in building instruments to study plant physiology through electricity. It made the *Times* bestseller list and was followed up by an experimental documentary film with the same name. It solidified the idea that plants are more than just inert and unresponsive entities, embedding this understanding deeply within the American cultural memory. Yet another notion that established itself at the time was the image of plants as organisms whose signals could be elicited from them by means of electronic devices.

Backster wasn't a biologist or scientist, but a lie detector expert who worked for the CIA. The psychoanalysator or 'polygraph' he used for his experiments was the standard lie detector of the CIA, except that its electrodes were now hooked up to a plant. When Backster began his experiments, he didn't pay attention to choosing specific plants, but opted for the ubiquitous, ordinary plants found in almost every office

setting, most notably the philodendron and the dragon tree. The polygraph measured the electrical resistance that changed with the degree of humidity. In other words, the cultural context of the research was truly different from that of Bose, who belonged to the Unitarian Brahmo fraternity in Calcutta, where Hinduism regarded plants as spiritual beings with unique souls that possess healing powers, sometimes even embodying sacred gods (Das 2023). Changes in the electrical voltage gradient of plant cells were displayed as a curve deflection and drawn as a line on a continuous tape. Backster's set-up seemed to prove that plants can also 'pass' a lie test, an assertion that has become firmly entrenched in popular memory.

If I concentrate on Backster's experiment, it is not because he played any role in plant research, but firstly because his experiments met with an enormous response from the public at the time, and secondly because Backster's general electrotechnical set-up continues to recur in new guises in the arts to this day, as in the examples I described at the beginning of this article. His experiments are embedded in the history of fascination that weaves into the framework of biological plant research. He became the point of reference for many media artists, who realised art works for the public – for example Miya Masoaka relates her work to Backster directly – where there is a vague longing to come into emphatic contact with plants, or even to exchange signals or at least to make the plant's signals perceptible, realised in the paradigm of the electrical *a priori.*

After numerous further experiments, Backster concluded that plants display 'a quality of awareness and an empathy to other organisms' (Tompkins and Bird 1973: 33). This is the moment at which the highly charged nature of Backster's credibility as an CIA-agent and lie detector specialist becomes clear in his role as the man who was finally able to 'reveal' plant language and truth. Indeed, the electrodermal reactions of the polygraph became forensic tools able to reveal a 'secret message', with Backster claiming the authority of the expert who could interpret any response pattern. This authority was based on the cultural myth that a lie detector test was 'unbeatable' and scientifically objective. The evidence was driven by the ritual of the test in the context of the intelligence services and the experts' interpretive authority.

Backster was not alone. Tompkins and Bird list many other protagonists from the fields of electrical engineering who experimented with

plants and auto-suggestion but who also used plants as receptors for intelligent signals from outer space and to harness the telepathic abilities of plants. Many presented their research at the Society for Cybernetics in 1972 as evidence of the transmission of a new energy form called 'bioplasm' (Tompkins and Bird 1973: 52–59). What becomes obvious is that all the experiments carried out in this period were closely related to the control engineering and cybernetic machines of the 1960s and 1970s, that is to media technologies.

It wasn't biologists, but rather electrical engineers and people claiming to be spiritual mediums who were using plants as biosensors for electromagnetic fields in the realm of bio-cybernetics, the attempt to use information theory and system theory to understand how biological systems 'function'. The fact that these experiments combined paranormal interpretations with modern technology meant that their findings were not published in journals of natural science, but rather in engineering journals with titles such as *Popular Electronics* and *Electronic Worlds*, or in para-psychological journals, such as *International Journal of Parapsychology*.

ELECTRO-TECHNICAL MEDIA AND THE 'BECOMING-MEDIUM' OF PLANTS

In all these experiments and in the mentioned artworks or apps, the key status of electro-technical communication media is clear. How can we best evaluate this connection? As Verena Kuni (2020) writes, the plants were 'perceived and modelled as media' (3, 5). They were turned into technical interfaces through electric circuiting making their signals accessible for visualisation or sonification methods. The film and media scholar Teresa Castro (2019) summarised the experiments in Backster's context using the terms 'mediated plant' and the 'queering of botanics' (n.p.) as a way of grasping the familiar rational notions of life and consciousness that had been challenged by these kinds of plant experiments. Although this effect might be true, I wouldn't go all the way with this interpretation, because it seems to repeat the idea that it's actually the plant that's being mediated.

What speaks against the idea of a queering is the fact that human feelings and thoughts stood at the centre of almost all the experiments.

The envisioned resonance between humans and plants tied to the myth of the infallible lie detector and the potential control through human will (a form of 'brain control'), loses its enchantment. This paradigm bears resemblance to the *E-meter* devised by L. Ron Hubbard, the founder of the Church of Scientology, who similarly employed the polygraph as a strategy to objectify 'emotions' and allow their subjective interpretation. This use of the polygraph is illustrating yet another instance of the creative interpretation of 'spurious correlations' in the form of lines which, in this case, make visible the electrical resistance of the human skin. A media theoretical assessment of the plant experiments within Backster's framework prompts enquiries into the instrumental role of plants in the experiments to recreate the human senses. The recurrent observation arises that the trembling deflections of polygraph needles conveyed less the feelings of the plants and more the thought-after human states of arousal within the plant's signal. The essence wasn't primarily about understanding plant sensations or consciousness; instead, it revolved around transforming plants into technical mediums capable of sensing and discerning 'human' thoughts and states of mind.

In these experiments, the role of plants emerges as something media theory has called – drawing on Gilles Deleuze and Félix Guattari – the 'becoming-medium' (Vogl 2001: 115–23). In this process, which Vogl exemplifies with Galileo's telescope, media don't simply expand the senses, but invent the senses in a new way. The telescope deleted the idea of 'natural seeing' and replaced it with a new artificial mode of perception, a 'denaturalization of the gaze' (116, translated by the author). And these instruments installed an 'elemental self-referentiality' (Ibid.).

This characterisation applies to most of the electro-technical plant experiments carried out in the late 1960s and the 1970s, rooted in the desire to transform plants into interconnected media within an electrical circuit. Notably researchers integrated the latest communication technologies of their time into their experiments, which, crucially, enabled plants to function as media in the first place. Against the backdrop of the electro-technical plant experiments sketched above, it is essential to recall the foundational aspect common to all these experiments – the galvanometer or polygraph. Restricted to a two-dimensional signal (time and Hertz), this device registers only the frequency of repeating processes in a periodic signal, resembling more a temperature curve than the richness of human language or music (cf. Rieger and Bühler 2009:

63). The signal to which all hopes of plant communication via feelings are attached is, therefore, notably feeble. Media historians Stefan Rieger and Benjamin Bühler (2009) emphasise that the excitement lies not just in deriving voltage differences but, more importantly, in how they are processed: 'It is the language that speaks, not the human being – or, in this case, not the plant' (Ibid.: 64).

LISTENING IN MORE-THAN-HUMAN WORLDS

In times of a global ecological crisis – diversity loss and climate crisis – new ways are sought to relate to ecology and nature. Listening is one mode by which to relate to species under the threat of a changing climate. Artist Marcus Maeder, for example, has worked in the field of eco-acoustics for many years. He translates his research into sound installations for museums. In his piece *Perimeter Pfynwald: A Soundscape Observatory* (2019), audiences can listen to the reinforced clicking sounds of a pine tree recorded during a period of drought and heat stress and relate the sounds to sonifications of meteorological data, measured in synch. The sound patterns are complex and hard to understand, but after a while they reveal the relation between changes in the environment and the clicking sounds of trees, who unsuccessfully try to pump up more water through their trunks. Art historian Yvonne Volkart wrote about the piece extensively in her book *Technologies of Care: From Sensing Technologies to an Aesthetics of Attention in a More-than-human World* (2023). Art works like Maeder's are often promoted as ways to make perceptible the impacts of climate change, but also as ways of listening to plants, opening up for new relationships of care. Volkart interprets this understanding going deeper and offering a way to reflect on the experiments of this chapter again:

> The fundamental sound, which transports the mood at the same time with interval-like flickering rumbling noise, is 'voice,' neither something human nor 'saying' anything. The listener only has the 'feeling' that it comes from deep down and far away and is ancient, a kind of earth tone or spirit. This indeterminacy leads to a permanent tension that is not resolved. The listener, or perhaps better experiencer, 'feels' that the forest represented here, which they hear and see and feel resonantly, is a body, a living being. That it is. They move in its terrain; they are affected by its mystery. Although Perimeter Pfynwald accomplishes these sound evocations entirely without narration and suggests, at least

> aesthetically, the information design of science or pedagogy, the atmosphere has something mythical about it, recalling in us non-modern knowledge in which the forest does not represent an outside, but is part of the body. At the same time, the artificiality of the sound, of the voice, conjures up a cyborg, something hybrid. The forest being, the forest body, the forest here is natureculture.

Feeling, understanding, listening and caring for living creatures across human species is much more complex than the idea of 'making plants speak'. The concept of queering here is linked to the figure of the cyborg, which shifts the understanding of a 'natural' relationship with plants.

It is true that current research is unlocking the way we think about plants. Language is crucial here, because it, at the same time, limits and opens up ways of understanding. If we say that we listen to the 'voice' of plants, we are applying an 'anthropomorphising' or 'animistic' inclination. The same is true for many books that have popularised the idea of plant intelligence successfully during the last years like those by Stefano Mancuso or Peter Wohlleben. This inclination is not confined to popular writing, but also manifests in the scholarly works of professional researchers such as forest ecologist Suzanne Simard or biologist Monica Gagliano. Potawatomi botanist and writer Robin Wall Kimmerer calls attention to the strict ban on anthropomorphising vocabulary in biology. At the same time, she calls for animistic approaches to nature to overcome the objectifying paradigm of Western thinking that separates humans from nature (Kimmerer 2013: 48–59). This is because a ban on the use of an anthropomorphic vocabulary is not neutral.

> As ecological thinkers have pointed out for a while, a systematic blindness to the enmeshment of human and non-human worlds stands both at the origin of global ecological crises and in the way of developing collective responses to them. As a result, we find ourselves in a situation where deeply entrenched critical reflexes are beginning to fail us and a critical habitus founded on exposing anthropomorphism in all its guises has become fundamentally questionable. (Wankhammer 2017: 143).

Gagliano refutes accusations of anthropomorphism (and unscientificness) and advocates for the 'plantifying' of our imagination concerning ourselves and all living creatures. The focus lies not on the metaphysical implication of anthropomorphism, but rather on the definitions of fundamental concepts intricately connected to the human image, such as language or cognition.

Resonance, if it is not 'hungry listening', in this context, can be a process of tuning in. Gagliano (2018) describes her research and her plant-centric writing as an 'attunement' (6). This concept diverges significantly from the electrical experiments of Backster and his successors. According to Gagliano, 'the human is a listener who filters out personal noise to hear plants speak, who engages in active dialogue with these non-human intelligences, which are far more real than our current scientific constructs allow us to contend with' (Ibid.). She further elaborates, emphasising the genuine act of listening involves feeling the other as we encounter them: 'This availability to truly listen by feeling the other as we meet is not empathy, which bears upon the other in order to rediscover himself – a form or narcissism that makes the other a sort of imaginative variation of the empathizer' (17). As the boundaries between the realms of plants and humans, plants and the media, science and poetry become increasingly blurred, the challenge is to develop a sense of critical awareness and care.

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