

you are variations

Report

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I, Christina Della Giustina, confirm that the work presented in this thesis is my own.
Where information has been derived from other sources, I confirm that this has been indicated
in the thesis.

In process a kind of music occurs naturally.

Its beauty is not through intention, but is intrinsically the effectiveness of its healing power.

This may be felt by the group, and the music relates to the people

who make it through participation and sharing,

as a stream or river whose waters offer refreshment and cleansing to those who find it.

– Pauline Oliveros

‘Introduction II’, *Sonic Meditations*, 1971

This research is dedicated to Joa, Lidia and Ivo.

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Abstract

you are variations is a ten-year-long study of tree water-cycles in which scientific climate change research has provided environmental data on sap flow that is here transposed into a musical score. The score is enacted live – including in-situ – in collaboration with electro-acoustic ensembles. By turning climate data into sound-performances, the research draws attention to the sophisticated energy balance of trees under changing environmental conditions, contributing to scientific research concerned with climate futures, and evidences a committed stance in art as sustained experimental (re-)search into transformative power.

Inspired ecopolitically by Isabelle Stengers, Donna J. Haraway and Bruno Latour, aesthetically by Pauline Oliveros and Catherine Christer Hennix et. al., the project exercises how to think and work across wounded worlds together. In gathering disciplines that are unfamiliar to each other – linking environmental, cultural and mental ecologies – the project reveals ‘difference’, theoretically drawing on the work of Alfred North Whitehead, Félix Guattari, Gilles Deleuze, Jean-Luc Nancy and Elizabeth Grosz.

The key methodology, ‘ecology of translation’, incites gaps and transpositions as acts of mediation in a complex process of evolving relationalities between art-music, science and the climate. It conceives of ‘trans-lation’ as human, and more-than-human activity; creative in the making of a ‘re-lational, resonant kinship’, based not on sameness, but alterity.

It is the experience of wholeness that is the significant outcome of this transdisciplinary practice across a vast range of contemporary climate urgencies. The conclusion elicits a new term for the felt experience of wholeness instantiated by *you are variations* performances: */wi/*. Addressing the problematic term ‘we’, exclusive in its presupposed inclusivity, */wi/* denotes the experiential communion of tree, you and self, exemplified in the poetic, ecopolitical movement the research brought about: in asking ‘Can we learn to listen to a tree?’ *you are variations* advocates how to become */wi/* with the world.

Impact Statement

you are variations operates across science, music and performance in art, creating lines of mediation, communication and exchange between these different disciplines. The research draws attention to the water and energy balance of trees under complex and changing environmental conditions. The queries raised are relevant for experimental research concerned with climate futures, and simultaneously address art's stance – that is, its responsibility, its moving fields of agency and the pivots of its transformative power.

The project proposes and practises facing urgent environmental challenges together. The research that informs it impacts the development of academic climate and sustainability research. Since 2011 I have worked in collaboration with the Swiss Federal Institute for Forest, Snow and Landscape Research WSL and its European network and global partners. In the publication *Recomposing Art and Science* (2016), Prof Dr Rigling, Co-director and Head of Research Unit Forest Dynamics at WSL, reports on the project's impact on his research, commenting on the benefits of its creative interpretation of sap flow measurements towards climate research, and the insight and awareness this has generated.

The approach to musical composition has brought about new insights into present-day orchestral performance and impacted musicians involved in performing the data scores, often challenging their approach to musical interpretation.

The research method has been widely recognised and shared through workshops at the Slade School of Fine Art, UCL; Art Academy of Fine Arts, Prague; HKU University of the Arts Utrecht; Zurich University of the Arts and San Francisco Art Institute SFAI. Promising continuations and future scholarships are planned in collaboration with Civil, Environ & Geomatic Engineering, Faculty of Engineering Science UCL, Princeton Environmental Institute, the Oxford Research Centre in the Humanities | TORCH, and Arts

Cabinet in collaboration with the Leverhulme Centre for Wildfires, Environment and Society and King's College's Faculty of Social Science and Public Policy and the Policy Institute, to devise transdisciplinary research for the study of arborescent behaviour in ecosystems, with sustained attention on how local activities interact with global formations from hydrological, anthropological, sonic and aesthetic perspectives.

you are variations has produced four books, twenty-two performances, nine sound-installations, nine video-installations and nine light-installations, and has been published widely. Its public reception has been remarkable. The imaginative approach in its 'ecology of translation' generates events, music and collaborations through the encounters it creates. Its results have entered public discourse through invitations to main cultural venues in Amsterdam, Bangalore, Basel, Berlin, London, Montreux, Prague, San Francisco and Zurich.

My thesis reveals that listening as 'active tuning in' can lead to a resonant mode of relation, */wi/*, an inclusive 'tree ecology'. A case study records the effects: in rehearsals for the second interpretation of a Scots pine suffering from drought in the Valais canton of the Alps – an intense collaboration between 4 musicians, 4 scientists, 25 children, one artist and a constellation of trees – a formerly mute child started to sing and speak. *you are variations* not only impacts children, but it might be one of its most noble and meaningful benefit.

Introduction

The remaking of politics must pass through aesthetic dimensions that are implicated in the three ecologies of the environment, the socius, and the psyche.

A response to the poisoning of the atmosphere, and global warming due to the greenhouse effect, is inconceivable without a mutation of mentalities, without the advancement of a new art of living.
– Félix Guattari, ‘Subjectivities: For Better and for Worse’, 1996

While the climate crises become unignorable and undeniable, it is during the last ten years that *you are variations* draws attention to the complex water cycling and sophisticated energy balance of trees under different and changing environmental conditions. The project transforms scientific measurements of water cycling through trees into a musical score,¹ where data on the water’s pathway, once translated and arranged into an electro-acoustic composition, is the sonic material.² The resulting performance aims to recreate the water cycle within a tree as a sonorous event.³

Queries raised within this process are relevant to contemporary regimes of scientific knowledge, especially those concerned with climate futures, and to art’s capacity to cultivate a set of environmental dispositions that cause pause and attention for sensing otherwise, leading from spectatorship to actual, inspired participation. In the midst of climate emergency, the project allows for the felt experience of togetherness, bringing about a deep sense of wholeness that challenges the thoughts on ‘who’ we are, if not who we are ‘together with’.

The research proposition is to broaden our modes and ways of sensing with the inherently political claim for alterity, providing */wi/*, an altogether different ‘we’: the */wi/ you are variations* generates and propels in the very act of performance does not define a group, but indicates a measure of resonance with the world.

¹ Data sourced from Long-Term Forest Ecosystem Research (LWF), which consists of 19 permanent monitoring sites since 1994, <https://www.wsl.ch/en/about-wsl/programmes-and-initiatives/long-term-forest-ecosystem-research-lwf/sites.html>. The LWF participates in the International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests, <http://icp-forests.net/> and the European Long-Term Ecosystem Research Network, <https://www.lter-europe.net/>. The LWF programme is run by the Swiss Federal Institute for Forest, Snow and Landscape Research WSL, <https://www.wsl.ch/en/about-wsl/programmes-and-initiatives/long-term-forest-ecosystem-research-lwf.html>.

² Thanks to Dorothea Schürch for pointing to the frequent use of the term ‘musical material’ in music- and sound-studies. The term ‘musical material’ deserves further research.

³ In the ancient Western interpretation a musical event (mousike – a union of song, dance and word, the realm of the Muses – an expanded sense of music, wide-ranging in its implications in antique Greek life) is different than the notion of music we commonly share nowadays.

⁴ See <https://www.wsl.ch/en/about-wsl/research-units/forest-dynamics.html> and <https://www.wsl.ch/en/about-wsl/programmes-and-initiatives/long-term-forest-ecosystem-research-lwf.html>.
I have been working with a varying selection of the following parameters:
– atmospheric deposition (measured 1996 - present)
– composition of ground vegetation (1994 - present)
– crown condition (1995-present)
– tree diameter and height (2000-present)
– EC-5 soil water content (2010 - present)
– leaf chemistry (1997 - present)
– leaf area index (1996 - present)
– lichens (2003 - present)
– litterfall (1996 - present)
– manual circumference band (2001 - present)
– soil matric water potential (1996 - present)
– meteorological parameters (1996 - present)
– ozone symptoms (2002 - present)
– ozone concentration (2000 - present)
– passive sampling of NH3 and NO2 (1999 - 2000)
– soil matrix chemistry (1994 - present)
– soil morphology (1994 - present)
– soil solution chemistry (1999 - present)
– tree cores (1998)
– crown transparency (1995 - present)
– deadwood sampling (2009)
– point dendrometer (2011 - present)

⁵ See <http://www.artistsinlabs.ch>; https://www.artistsinlabs.ch/en/research_publications; documentary (2012) by Jill Scott and Marille Hahn on the initial research conceptualisation: <https://www.youtube.com/watch?v=qLS-vLrmcSw>.
See also *Recomposing Art and Science: artists-In-labs* (2016), <https://www.degruyter.com/document/doi/10.1515/9783110474596/html?lang=en>.

⁶ See <https://www.wsl.ch/en/about-wsl/research-units/forest-dynamics.html>.

⁷ See <https://www.wsl.ch/en/about-wsl/programmes-and-initiatives/long-term-forest-ecosystem-research-lwf.html>.

The project *you are variations* is a direct result of the collaboration with the Swiss Federal Research Institute for Forest, Snow and Landscape Research WSL, where the climate data I am working with is collected and where I was invited in residence as ‘artist in lab’ during 2011.^{4,5}

Prof Dr Andreas Rigling, head of the research unit Forest Dynamics and I have worked intensely together:⁶ since 2011 in the frame of the artists-in-labs programme of Zurich University of the Arts, using data from the Long-Term Forest Ecosystem Research (LWF) programme,⁷ since 2014 in the frame of the Velux Foundation’s Daylight Research with data from FunDiv_Europe,⁸ and since 2018 in the frame of ICP Forests, a programme aiming at a comprehensive compilation of information on the condition of forests in Europe and beyond, driven by an ongoing, immersive and creative dialogue.⁹ We are impelled to present scientific and artistic discussions on trees in the public domain together.

The residency allowed me to study the WSL’s language and methods. I compared scientific and aesthetic processes to explore whether their practices can be brought into working relation with one another, and if so, in what ways they connect, diverge and disconnect, and what might be the adventure, the challenges and the value of doing so.^{10,11}

The urgency to work on the gaps that divide science from art and theory from practice – a whole set of binary divides the Western history repeats on many levels, present also in the distinction between nature and culture – became evident to me in 2011 and guides the entire PhD research from its beginning in 2014 until now.

My artistic collaboration with the scientists at the WSL queries our identities and tests the monolithic characterisations that each of us has acquired as a result of being placed in opposition to one another.¹² The critical art-science collaboration we developed questions not only the familiar notion of objectivity, but inevitably the notion of subjectivity as well!^{13,14} – in resistance to the lure of polarising subjects and objects, fact and fiction, truth and illusion, the empirical and the hypothetical, scientific and aesthetic practices.

While our art-science alliances have lost the attraction of embodying the juxtaposed and exotic lure of working with opposites, we gained two priceless acquisitions: natures *and* cultures. In the collaborative practice it is the demanding exercise of registering differences in each other’s perception without experiencing them as threatening. What if our relationship was understood not in contradictory, contentious or dialectic terms, but as a developing relationship of growing similarities, contrasts and gradients of divergence and differences? This is an alternative art-science formation in which not-knowing, together with an alternative, situated and generative notion of learning from each other, genuinely flourish together.

By turning ecophysiological long-term monitoring measurements from climate change research into events of sensory experience, the project transforms numeric records into tangible events and addresses data’s intangibility. It does so by experimenting with different modes of interpretation and sensing, to reconnect the data back to its physical referent: to specific, single living trees.

It is in accord with Nancy, when he states:

It is a question of going back to, or opening oneself up to, the resonance of being, or to being as resonance. ‘Silence’ in fact must be understood [*s’entendre*, heard] not as a privation but as an arrangement of resonance: a little – or even exactly ... – as when in a perfect condition of silence you hear your own body resonate, your own breath, your heart and all its resounding cave ... It is a question then ... of going back to ... a resonant subject, an intensive spacing of a rebound, that does not end in a return to self without immediately relaunching, as an echo, a call to that same self. While the subject of the target is always already given, posed in itself to its point of view, the subject of listening is always still yet to come. Spaced, traversed, and called by itself, sounded by itself.¹⁵

⁸ See <https://daylight.academy/> and FunDivEUROPE (Functional Significance of Forest Biodiversity in Europe), a collaborative project within the European Seventh Framework Programme (FP7) with the overall goal to quantify the effects of forest biodiversity on ecosystem functions and services in major European forest types, <http://www.fundiveurope.eu>.

⁹ International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests, operating under the UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP), <http://icp-forests.net/>.

¹⁰ The *interest* that the scientists and I share in trees, is etymologically linked to ‘be[ing] (situated) in between, a phrase I adapted from Isabelle Stengers, according to whom the passage from innovative fiction to scientific proposition takes *interest* as its key word. In her eyes, the so-called ‘autonomy of the sciences’ (and I would like to suggest the so-called ‘autonomy of the arts’, too) is related to the fact that *interest* as *standing in between* goes along with *taking risks*. Stengers, 1997, p. 84.

¹¹ Throughout the text I repeatedly refer to the etymology of words appearing in this report: their roots, linguistic branching, life spans etc.

¹² Stengers, 1997, p. 110.

¹³ As outlined a.o. in Lorraine Daston and Peter Galison’s emergence of *Objectivity* (2007) in the mid-nineteenth-century sciences, a detailed history of scientific objectivity and a history of the scientific self.

¹⁴ With regards to ‘subjectivity’, the report especially refers to Félix Guattari’s ‘Subjectivities: For Better and for Worse’, an essay on subjectivity as complex, fluid self-creation, in itself political. It argues for the importance of what Guattari calls ‘ethicoaesthetics’. Another article that supports Guattari’s understanding of subjectivity is Stengers’s ‘Experimenting with Refrains: Subjectivity and the Challenge of Escaping Modern Dualism’ (2008). Stengers speaks about the production of subjectivity

as a process, or as biologist Francisco Varela calls it, autopoiesis: subjectivity as process of reclaiming, reappropriating and integrating what we/I have been separated from. In ‘Subjectivities: For Better and for Worse’, we find Guattari increasingly emphasising the continuous engendering process of subjectivity or subjectivation – understood neither as individual opposed to society nor collectivity, nor to any kind of objectivity, that is not as a universalist representation of subjectivity as embodied by the capitalistic colonialism of the West and East – but subjectivity as plural, heterogeneous and polyphonic. It is continuously nascent, emergent. It is as Varela points out, an autopoiesis – in any case a practice and a creation, a creative practice.

¹⁵ Nancy, 2007, p. 21.

This circular movement – from (living) tree to (incorporeal) data to (physical) sound as (living) tree – reoccurs as a cyclic trope throughout the research. By musically processing each data set into a score and sets of scores into a composition, by rehearsing the composition with musicians and performing it on the site where the data is gathered, *you are variations* attempts to bring the data (back) to the topographical place from which it comes, this time in the form of a sonic event.

A circular trajectory exemplifies the effort to give the data back to the tree, and in this aspiration to reunite ourselves with the tree. If the circle is not closed, it also cannot restart. In this sense, it felt as if the data captured were stolen from the tree, and left us and our relation with the tree, and with it all life it accumulates and entails, dissociated and fragmented. The artistic endeavour to return the data, close the cycle and allow for wholeness among tree, you and self, involves working together with the most different disciplines, divergent forms of knowing, diversified instruments and many diverse organisms – human and non-human. On the macroscopic level, it is the practising of togetherness as the very ethics of contemporary ecopolitics. On the microscopic level, it is the continuous rehearsing of (new) forms of togetherness that describe the entire trajectory the research project has taken: from 2011, when I addressed the tree by proposing the title *you are variations*, introducing the relation I – you; all the way to this concluding moment, which can be described as a practice of inclusion and that I phonetically mark as */wi/*. The creation of a new *we* (*I, you and the tree*), which *you are variations* invents, identifies and names with the phonetic sign */wi/*, is necessary, because ‘we’, the first-person plural personal pronoun used in Modern English stands for a defined group and fails to include yet-unknown others. It becomes especially problematic within the context of regular abuse throughout history in the claim of a universal ‘we’, such as ‘we humans’, ‘we men’, etc., where ‘we’ stands for a universal generality, presenting ‘we’ as the result of a predescribed definition, with the inevitable result of inherent exclusion. The anonymous ‘we’, the general ‘we’, as well as the exclusive ‘we’, is trapped in presenting themselves as universal. We know from history that these ‘we’s’ easily become disastrous.

/wi/ stands for meeting in dignity. It shares more similarities with a verb than with a pronoun in Indo-European languages. It cannot be defined in terms of generalities, but requires talking about – or being able to talk about – one’s own attachments, wounds and urgencies. It means understanding the political importance of one’s own, personal, specific conditions, in order to politically share and act together with others, perhaps with very different others and maybe for apparently very different reasons.¹⁶

Climate change and the hybrid operations of the forces at work today display a complexity of entanglement that no single disciplinary approach, no mono-perspective methodological tool, and no solitary operation of knowledge production can tackle adequately. What is needed today is a collaborative, trans-/and de-disciplinary combination of critical forms of knowing that confront head-on the paralysing conditions of contemporary notions of so-called progress, specialisation and individual freedom. An alternative pluralism though cannot be understood as a plurality of viewpoints alongside each other on one and the same reality. Perhaps a multiplicity of modes of existence and types of agencies that together make up our lives have to join forces and unite.

The project investigates how we can understand dynamic processes in trees and environmental change through aesthetic experience and how these experiences reconfigure our personal relationship with difference and the other, as well as our political relations to human and non-human worlds. The other, the tree, is not out there, but in here. The question is how we can become other, other to others and ourselves?

In Elizabeth Grosz’s words: ‘Becoming is really a process of un-becoming [...] of undoing the givenness of the given [...] how we can become unrecognisable.’¹⁷

you are variations commits itself to the contemporary problems of relating to this world of ‘unlikes’ on personal, social and planetary levels, that is, holistically. Attending to a relation with trees – beings that differ from ourselves – forces self-questioning. What *you are variations* found relevant to this process is neither to do away with our self, the human, nor to (re)define him, her or they. Of relevance, I would like to suggest, is to open ourselves to

¹⁶ What Stengers calls ‘reclaiming’; a.o. in the following passage in an Interview with Stengers by Casper Bruun Jensen and Line Marie Thorsen: ‘What strikes me is that the witches’ Reclaiming movement has endured and expanded and is now in deep participative connection with other activist movements that also experiment with paths of reclaiming. To reclaim means to struggle but also to heal and become able to confront what you struggle against without becoming like it. To win, then, would not mean that you have proved stronger than the other, by using the same kind of force. It would mean that you have connected with other forces, or cultivated the resurgence of forces we were separated from. ... Cosmopolitics, then, is a matter of reclaiming trust, not blind trust, but educated trust.’ The Reclaiming Collective combines Neo-Paganism with feminist, political and environmental activism. It was founded in 1978 by Starhawk and Diane Baker. See also the chapter ‘Theoretical Framework’ in Appendix 01.

¹⁷ Elizabeth Grosz, keynote, 1st Annual Feminist Theory Workshop, 23–24 March 2007, <https://www.youtube.com/watch?v=mwHoswiw5yo>. Becoming involves rethinking the entire ethics, aesthetics and knowledge economies between human and non-human worlds, and how organisms emerge from co-joined experiences.

the forgotten and/or yet unknown bond, to */wi/*. In rethinking our relationship to trees we open ourselves to the kind of art that is adequate to the task; an art that enables us to sense the myriad ways in which we are connected to each other and to the broader realm of life. This profound connection and infinite interconnectedness at the heart of ecology is the actual cosmology of *you are variations*. It changes what it might mean to be human, or better, what ‘to human’ as an active verb might come to mean.

One thing it could mean is to enter a world that is in relationship with itself.¹⁸

The project began in discussions on whether scientific and aesthetic processes can be brought into a working relation and turned into collaborations with scientists, musicians and other participants that investigate our similarities as much as contrasts, variations and modalities in-between.

This thesis traces the long road in *you are variations* not from a master viewpoint that floats above, but in accord with the term methodology’s own etymology, that is, ‘along and according to the path, while walking’:¹⁹ first was the desire to enter the tree, to merge with it physically.²⁰ This was followed by the rejection of such desire, having to admit that union is not possible in this way. There followed a process of grieving the divide, the rift and the distance, while learning to communicate and work with the scientists and the musicians involved. I learned to mourn sonically, publicly and in doing so allowed for relationality to emerge in a paradoxical and surprising manner: the separation transformed into a resonance chamber that resounds with the pain of the divide. It is the *you are variations* music that recalls the fragility and labour in the continuous refinement of relationality, a living relation that evokes connection and togetherness, and leads to the felt experience of wholeness, identified and named by the *you are variations* new word made up of the phonetic sign */wi/*.

The common thread that weaves itself in and out, transversing vast historical, theoretical and discursive layers, is the *you are variations* artistic practice, which initiates with a systemic mode of composing, gradually integrating process-driven rehearsals and collaborative performances. Its emphasis in the proliferation of live events is on embodied forms of knowledge,

setting up the aesthetic conditions that allow for the felt experience of wholeness. As the project touches upon a nexus of issues, several contexts and discourses are addressed simultaneously, all with an underlying critique of the bifurcation of art and science: their splitting of the rational and intellectual from experiential, embodied forms of knowing, as well as the expanding specialisation and fragmentation of knowledge in our educational institutions and their wider contexts and applications. In parallel, there is a corresponding differentiation between sciences of the humanities and sciences of nature, together with the categorisation and distinction between human and non-human beings, forces and things.

Within *you are variations* lines are (re-)drawn among cosmological notions of Western and Eastern music as systems of order that mediate between natures and cultures. Since antiquity, in cosmic Indo-European thought music’s ordering relation of nature and culture is commonly attributed to Pythagoras.²¹ As ‘harmony of the spheres’ – a concept that reads the movements of celestial bodies (astronomy, nature) as a form of music (aesthetics, culture) – it revived in the Renaissance, especially within the context of hermetic philosophy. This notion of music as a simultaneously physical, sonic, mental and spiritual complex permeates in the most divergent ways into the twentieth and twenty-first century. There is no doubt that Iannis Xenakis, Karlheinz Stockhausen, John Cage, La Monte Young, Terry Riley, Steve Reich, R. Murray-Schaffer, Hildegard Westerkamp, Pauline Oliveros and Catherine Christer Hennix – among many others – are very different composers, but what is evident is that their approaches to life are sonic, which means their notion of music – even in their differences - is a cosmological one.

The hypothesis in *you are variations* is that contemporary soulmates in this long lineage of holistic understandings of music can be found in transdisciplinary, ecopolitical acoustic projects of the twenty-first century too. In this thesis, these lineages and connections among projects and time frames are organised along two contextual frameworks: musical-historical and theoretical-linguistic. The chapters ‘Historical Framework’ and ‘Theoretical Framework’ in Appendix 01 accordingly detail musical and mental cosmologies related to the project.

²¹ I am aware that my limited understanding of this complex history is only one possible reading of Pythagorean cosmology, and that a large body of research and literature remains undiscussed in this thesis.

¹⁸ Connecting again to Nancy’s understanding of listening: ‘To listen is to enter that spatiality by which, at the same time, I am penetrated, for it opens up in me as well as around me, and from me as well as towards me: it opens me inside me as well as outside, and it is through such a double, quadruple, or sextuple opening that a “self” can take place.’ Nancy, 2007, pp. 13–14.

¹⁹ Methodology – from Greek μέθοδος: μετά (meta) = ‘along, concerning, in pursuit of’ and ὁδός (hodos) – ‘a way, path, road; a ride, journey, march’. For the semantic development, compare English ‘road’ from Proto-Germanic **raidō* (‘ride, journey’), from Proto-Germanic **ridanq* (‘to ride’). In my use of ‘methodology’ I refer to the literal interpretation ‘according to the road’, which emphasises the idea of ‘method’ not as ‘predescribed recipe or formula’, but as a practice ‘along a path’ that is developing and becomes discerned as ‘moving while working’.

²⁰ This study is not about DNA, but with reference to a physical merging, it is remarkable how much DNA we share with trees. Depending on the tree species, it varies, but at minimum 50%. This shows how closely organisms on Earth are related, and indeed tells something about genetic relationships with trees. See <https://thednatests.com/how-much-dna-do-humans-share-with-other-animals/>.

A daring three-step process conveys the overarching spiritual understanding of music as resonance that pertains to everything and brings wholeness; as with a tightrope walker's balancing pole, it points to particular, situated examples and insights at one end and to possible conceptual and contextual interconnections at the other:

1) I begin by providing the ground of ancient Western notions of cosmic resonance between the microcosmos and macrocosmos and their reinterpretation and reinvention as 'Harmony of the Spheres' in the early Renaissance.

2) I then focus on twentieth-century music cosmologies, especially three of its influential protagonists that are of eminent importance to *you are variations* in its becoming, processing and aesthetics:

- Pauline Oliveros (deep listening, Sonic Meditations, sonic awareness)
- Catherine Christer Hennix (tuned Just Intonation drone music, base-level interactions between small clusters of 'pure' frequencies, the melting of 'music' and 'sound')
- Hildegard Westerkamp (the soundscape, World Soundscape Project, listening to the environment)

3) The last step comments on current artistic, musical and ecopolitical practices characterised by transdisciplinary methodologies and which engage the planet as a whole.

A literature survey of texts on political ecology by Félix Guattari, Gilles Deleuze, Bruno Latour, Gregory Bateson, Philippe Descola and Michel Serres, as well as Jean-Luc Nancy's *être-avec*, comprise the project's discursive and linguistic contexts. The survey opens up a dialogue of non-dualism and proposes unprecedented pluralities: mathematician and philosopher Alfred North Whitehead's philosophy of organism and process studies provides a vocabulary to question how we think with – and not about – trees, and Donna J. Haraway's and Isabelle Stengers's materialist feminist studies are engaged with through the framework of 'The Whitehead Research Project'.

The commonality among all theorists is Baruch Spinoza's ethics.

With these texts *you are variations* re-opens the Western conflict between the fluid, rhizomatic and the hierarchical, arborescent metaphors, this time

though as a conducive potential, fraught with tension. Do both metaphors stress two mutually exclusive perspectives? Or do they constitute and reveal two sides of the same coin?

you are variations comes to a vision that allows one to encompass and trespass both mindsets – the vertical, arborescent perspective, as well as the horizontal, rhizomatic perspective – and identifies both their legacies as two aspects of an interdependent system within a binary world that only knows to think in terms of 'either – or'. There are complex injustices at the intersection of climate change, late capitalism, economic liberalism, human and more-than-human exploitation and persistent colonialism, obsessive technological increase, excessive globalism, rising nationalism, etc. These are not dealt with, neither through the conceptual propositions of Western arborescent dualism, nor through unconstrained, wild, rhizomatic, horizontalism.

It might be pivotal at this point to recall that *you are variations* is an art practice. What this practice brought about – not next to but through 22 performances, 11 sound installations, 9 video installations, 9 light installations, 4 books, an ongoing series of online and offline lectures and a wide range of publications – is a peculiar and surprising negation and integration of philosophically opposite strands. The research goes beyond abstraction, generating and propelling a novel sense of trusting, partaking in and acting together with the world, a disposition that welcomes who and what has been divorced, excluded and silenced by the increasing and disenchanting technocracy of the last 300 years, including the unintended, the not-yet and the unknown. In the meantime, the Western-split-minds keep fighting themselves and each other in different disguises and by doing so destroy the planet, while their simplistic and aloof detachment remains entirely ignorant of Earth's agency.

In facing yet another divide, that between art and science *you are variations* proposes transcription, transpositions and transmission between disciplines, reference systems, grammars, media, institutions, publics and languages enacting an 'ecology of translation' methodology. As artistic observation of science at work *you are variations* assembles systems that are diverse and unfamiliar – the periodic table and its reading as musical scale, for example, or the molecular formula and its reading as rhythmic instruction;

also measured global solar radiation, the energy of the sun, and its reading as the overall tempo of the entire piece. These are examples of ‘translations’ from one system of order into the other. Aggregating organisational, compositional and instrumental cultures foreign to one another leads to an interlaced artistic concept, a complex musical score and demanding live performances: the versions of *you are variations* are durational; the combination and interaction of sounds is unfamiliar; the overall musical suspense is minimal, stretched and at the same time unpredictable. The transdisciplinary work in this ecology of translation engages in three main methods throughout as many phases in the working process:

- 1) The Score: with the premise of notation as diagrammatic, that is, musical notation as a thinking tool (the calculations of pitch, tempo and rhythm, followed by instrument-specific articulations)
- 2) The Rehearsal: inter- and cross-disciplinary divergence, the branching out into alterity
- 3) The Performance: music as resonance, or how sound touches all

These three main methods are followed by two case studies to exemplify the project’s ways of working and various effects it produces:

- 1) A formerly mute ten-year old child has an intense experience of */wi/* that allows them to speak
- 2) */wi/* communicates interculturally across worlds, i.a. through unorthodox pitch calculations according to Western principles of chemistry and physics that coincide with an old classical Indian *raga* preserved in traditional Hindustani and Carnatic music

A detailed account of the scoring process along the trajectory from data to music with scientific charts, notational diagrams and tables that lead to the musical scores can be found in the ‘Methodology’ chapter. In the formalisation of science, the scientific process is placed outside the content being studied. The methodology of *you are variations*, however, is characterised by a genuinely processual attitude. It is systematic, as much as unverifiable, unprovable and unrepeatable. Via its methodology things come alive in a continuous, if staggered, series of composing and rehearsing, trial

and error, and modification and transformation – which allows for processes of becoming. This report can only provide the thinking behind the composition and the scores produced. The actual music it co-engenders is made by the spirits of grand trees, by wonderful locations and exceptional spaces, by time and again highly engaged scientists, musicians, audiences and many more constituents in play.

Finally, the appendices provide more detailed insight into the project’s historical and theoretical contexts and contain the data trajectory, scores, performance documentation, events and outlines for future plans.

What I hope is for this thesis to present *you are variations* as a mode for reconfiguring sustainable relations as ecologies, and for the laborious act of weaving, fostering and strengthening them.

As central attractor, *you are variations* discloses the split between the tree and me as cultural hyphen within ourselves. It is this gap, which acts on many fronts, that is the *you are variations* leitmotif. The gap invents a temporalisation that holds the process of experiencing it together as an event, promoting active, processual ruptures and mixtures in and from dominant artistic and scientific structures and semiotical significance. *you are variations* is a catalyst of unique singularisation *and* pluralisation, bringing about a new trans-subjectivity and togetherness that counts for trees as much as for myself and yourself. The gap between us paradoxically functions as the project’s vessel for sound – the medium of relation. The doubling of the paradox lies in the fact that the *you are variations* rupture consists of separating itself from a binary system: the interval, which appears in the moment we dare to face these double-separations creates a sounding medium that holds the possibility for a new kind of */wi/*. The third and last paradox lies in the surprising fact that this process of trans-subjectification goes hand in hand with the capacity for relationality: it directly leads to the experience of */wi/* in its entire, unanticipated and unforeseeable potential.

By all means let us not mix up knowledge, interest, justice, beauty, and power;

let us not confound heaven with earth, the global stage with the local scene,

the relevant with the irrelevant, us with the tree.

– Bruno Latour, *We Have Never Been Modern*, 1993

Research Questions and Aims

... everything perceived is in nature ... ,

... to analyze how these various elements of nature are connected

Natural philosophy should never ask, what is in the mind and what is in nature.

– Alfred North Whitehead, *The Concept of Nature*, 1920

... (in a certain way, is there not always landscape in music, and vice-versa?)

– Jean-Luc Nancy, *The Ground of the Image*, 2005

... the successful soundscape composition has the effect

of changing the listener's awareness and attitudes towards the soundscape,

and thereby changing the listener's relationship to it.

The aim of the composition is therefore social and political as well as artistic.

... [I]t enhances our understanding of the world,

and its influence carries over into everyday perceptual habits. ...

Thus, the real goal of the soundscape composition

is the reintegration of the listener with the environment

in a balanced ecological relationship.

– Barry Truax, 'Soundscape, Acoustic Communication & Environmental Sound Composition',

1996

The research aim of *you are variations* assigns itself to the assemblage and expansion of three main branches of knowledge, treating them as inevitably – perhaps even promisingly – intertwined:

1) Inviting, calling upon and allowing: *the ecological respect*

(linking the study to signal legacies of political ecology):

with its activity, composing, understood in the sense of

bringing together, organising, arranging (*componere*)

2) Generating: *the artistic prospect*

(feeding the creative, prolific potential):

with its activity, composing, in the sense of ‘inventing, orchestrating, making’ (*compose*)

3) Contemplating and communicating: *the philosophical aspect*

working with discursive frameworks for the sake of naming and

sharing publicly:^{22 23}

with its activity, composing, in the sense of ‘articulating, linking, digesting’ (*compost*)

²² ‘A slow epistemology of perplexity’ as Isabelle Stengers proposes in ‘The Cosmopolitical Proposa’l, in Bruno Latour and Pieter Wiebel (ed.), *Making Things Public*, 2005, pp. 994–1003.

²³ Theoretical physicist David Bohm is one example of someone who was influenced by Alfred North Whitehead’s philosophy of organisms. Other scientists include physical chemist Ilya Prigogine, philosophers Isabelle Stengers and Donna J. Haraway, biologist Conrad Hal Waddington, geneticists Charles Birch and Sewall Wright a.o.

²⁴ In mobilising trees to think neither solely epistemologically or ontologically, but situating my research project in the vicinity of Whitehead and his kin, I also place it directly in the company of two eminent anthropologists, Philippe Descola and Eduardo Viveiros de Castro, who have greatly contributed to the recent debate on contemporary perspectives on natures, cultures and their divide. Their work has gained traction in diverse disciplines exactly due to the ways it renders epistemology and ontology plural – as epistemologies and ontologies – without turning them into culture versus nature. Instead, it allows them to encompass ‘different worlds, instead of different worldviews’, as Candeia succinctly formulated in 2010, quoted in Eduardo Kohn, *How Forests Think: Toward an Anthropology Beyond the Human*, 2013, p. 175.

²⁵ Candeia, 2010, p. 175.

²⁶ Strathern, 1988, p. 20.

The three aims – in correspondence with the three branches

ecology, art and philosophy – pursue an overall sensitising, vitalising and

extending of scope. An example of the interaction of these branches of

knowledge and their effects can be found in the intention of the research to

follow a circular trajectory that brings the data back to the place from which it

comes – returning the data to the tree. The mode is ‘full circle’, reinvesting the

starting point with a gesture that attempts to close the gap between abstract

and actual environments.

The encompassing aspiration is an inclusive, transdisciplinary

approach towards a plurality of perspectives and practices – an accumulation

of differences and modes of (not-)knowing – as particularly interesting and

potentially generative of new directions. With *you are variations* I hope to

contribute to an emerging vision of trees. By co-creating works that enable

intense experiences of the fluctuating dynamics of the tree and its ecosystem

as a continuously unfolding musical sound, I invest in a refining and extending

of our sensing capacities, with the wish to contribute to a subtle, but thorough

reconfiguration of the human with the planet.^{24 25} It is an approach that

proposes rethinking the sorts of concepts we use to make new ones with; in

Marilyn Strathern’s words: to create the conditions for new thoughts.²⁶

In this chapter I ask: How do sound-music artworks address

ecological issues? How can one transpose mathematical data to sound and

sound to music? What are the effects on the participants in understanding the

impact of the data and in relating to the tree? How does *you are variations*

change our experience and understanding of the pronoun ‘we’? These questions

reflect on how we can think with trees as something that extends beyond the

two modes of cognition provided by dualistic thinking: our distinctively human

socio-culturally constructed realities and the objective, physical matter that

exists out there beyond us.²⁷

Can we learn to listen to a tree?²⁸

By learning to ‘listen to a tree’, I do not mean sitting next to a

tree and listening to the wind rustling the leaves, recorded by microphones

or special sensors, etc. In *you are variations* one listens to the transposition of

such scientific measurements into a sound score, performed live by an electro-

acoustic ensemble.²⁹

The educational aspect of the question ‘Can we learn to listen to

a tree?’ can be understood as:³⁰ Can we learn to listen to a tree, like we learn to

listen to music?³¹

The question can also be read as: What does it take to learn to listen to a tree?

Or: Can we learn to listen to something that at first appears to be silent? Further

questions that then arise are: What does learning to listen to a tree do to us?

What happens when we learn to listen to a tree?

Even if each cluster of questions coheres, the report poses the

two types sequentially: first, those that concern discursive research around the

question ‘can we learn to listen to a tree?’, that is, learning to listen to a tree as

we learn to listen to music; and second, those related to what learning to listen

to a tree *does*, which is approached indirectly through two case studies that

exemplify the diverse effects that have emerged from the project.

²⁷ I am especially thankful to Isabelle Stengers’s books *Penser avec Whitehead* (2002) and *Power and Invention: Situating Science* (1997). Here a list of further authors who refer directly to Whitehead’s philosophy of organism and process studies, as well as Spinoza’s ethics: Guattari, *The Three Ecologies*, 2000 and *Chaosmosis: An Ethico-Aesthetic Paradigm*, 1995; Bateson, *Steps to an Ecology of Mind*, 2000 [1972]; Latour, *Politics of Nature*, 2004; Latour and Peter Weibel (ed.), *Making Things Public*, 2005; Deleuze, *The Fold*, 1993; Tim Ingold, *The Perception of the Environment*, 2000.

²⁸ And if learning to listen brings about relationality, do trees – in turn – listen to us? This follow-up question manifests itself in the research in such a way that it exemplifies the relational effects that listening (and in this sense *you are variations* as a project) bring about. The question came up during my studies, and without knowing how to frame it, it kept reoccurring in that I kept articulating it.

²⁹ Even if the image of the tree as conductor actually does come to mind: the conductor as connected and connecting; the conductor tree as antenna; the tree as medium.

³⁰ Educational, from ex – ‘out’ and *-ducere* ‘lead’, in the etymological sense of ‘leading out’. In this literal sense the question leads us also out of traditional understandings of music.

³¹ This can open up big questions around learning to listen to music, differences between Western scales and Indian ragas, etc. The research cannot dive into these questions, as each one would deserve another thesis.

The first set of questions are speculative and linked to how our modes of thinking can transform. In asking whether we can learn to listen to a tree, we find ways of questioning the habit to continually re-establish dichotomies between what is real and what is imaginative – and thus imaginable – an indicative split that has led us to an impoverished view of life and of each other.

The second set of questions, the possible effects and outcomes of what learning to listen to a tree *does* to us, evidently can only be answered in retrospect, that is, once we indeed learn to listen to a tree.

Bringing these two sets of questions together, the overarching questions then are: Does *you are variations* actually foster such processes? Has it already supported instances of learning to listen to a tree?

To be able to address these questions, the experience of the work is by definition an indispensable and decisive condition, together with referring to and reporting on the experience of others. This report – the tongue of the thesis – gives an account of the project’s research: the mode of presenting and accounting for resists ‘talking about’ *you are variations*, and instead invests in ‘talking with ... , trees, references, you, etc.’³²

The impact of listening to a tree is tangible in the language of the thesis: the way the report is written; its modes of address; its semantics, phonetics, tone and timbre. What has become obvious too is that the report emphasises the phonic side of the word: it reveals sound as signifying by pointing to intonational aspects and their material signification; it plays with syntactic and phonetic nuance, variations on these, and semantic as well as lingual associations; and with repetitions that enact the volition of a mantra. It is in constant search for linguistic activity and verbal alchemy, investigating in connections and interrelations; it articulates and gesticulates and reiterates and echoes and listens to the self and other, not due only to semantic reasons, but for the sake of a palpable mode of rhythmic thinking that goes together with a feeling of process that draws in whole organisms; it is a movement that creates not universal time, but a very particular temporality: the quality of the time you and I share with this text.

The points at issue are complex and intertwined. Can we conceive the research questions as seeking out novel thought processes rather than answers? And are we prepared to work with processes that might happen unexpectedly, suddenly or extremely gradually? We might need to hold conflicting positions and incomprehensible paradoxes.³³ We might meet discomfort on the way. How do we foster a concern that belongs to the art of ‘staying with the trouble’,³⁴ that is, not to give an answer to ‘the trouble’ in terms of abstractions or solutions or surrender, but to give our encounters and dialogues with trees and each other the power ‘to trouble’ our thinking? It is with these questions in mind that I suggest we (re-)turn our attention to the first question *Can we learn to listen to a tree?* and investigate its components:

³³ Such as allowing for the painful separation from the tree to be truly felt, paradoxically as the very condition enabling the experience of (a new) connection with the tree.

³⁴ See Donna J. Haraway, *Staying with the Trouble* (2016).

‘**Can**’ we learn to listen to a tree?

With the verb ‘can’ the question implies a potentiality. What if it is possible to learn to listen to a tree? What if a profound inclusion, integration and interaction of (trans)disciplinary methodologies, of scientific and aesthetic forms of knowing, can actually transform our experience and engagement with creation and lead to as yet unknown modes of relating to ourselves and the environment? Eva Schaper has described this formulation of ‘what if’ in terms of an ‘as if’ – similar to philosopher Quentin Meillassoux’s *‘peut-être’*, ‘can-be’, ‘may-be’. It entails not only to envision, how things *could be*, but how things *can be*.

Can we learn to ‘**listen to**’ a tree?

The research as a whole examines the idea of ‘listening’ as an activity that asks for a multidimensional and polyphonic attention towards the inside and outside – a craft and expertise that can lead to the development of closeness, connection and engagement, and perhaps genuine communication. By examining the idea of listening as relational, material and performative, that is, as sentient *and* political, *you are variations* asks:³⁵

³² Can the voice of this text, too, leave the written page and move towards you, me and the tree? Can this report, too, in experimenting with language and exercising a connected way of writing, not only foster, but also engender the new relationality it addresses?

³⁵ Listening – hearing, hearken; *lauschen* – *hören, horchen; luisteren* – *horen; ascoltare* – *udire, sentire; écouter* – *entendre*. Also with reference to Nancy, 2007 and the exploration of the verb listening in different languages and their etymologies, p. 5. Aboriginal Australian words for ‘listening’: *Kulini* – wanting to listen, needing to listen; and *Gan’na, Winangar guru* and *Caber-ra-Nung. Dadirri* – quiet still awareness. The Chinese sign for listening is a heart and an ear. In Latin ‘*auscultare*’ and languages of latin origin, ‘*ascoltare*’, ‘*écouter*’, ‘*escuchar*’, ‘*escutar*’: from aus-, the original stem of *auris* (‘ear’), + Proto-Indo-European **kel-* (‘to incline’): leaning towards the ear, paying attention to the ear. English listen (v.): Old English *hlysnan* (Northumbrian *lyсна*) ‘to listen, hear; attend to, obey’ (transitive), from Proto-Germanic **hlusinon* (source also of Dutch *luisteren*, Old High German *hlosen* ‘to listen’, German *lauschen* ‘to listen’), from PIE root **kleu-* ‘to hear’. This root is the source also of Sanskrit *srnoti* ‘hears’, *srosati* ‘hears, obeys’; Avestan *sraothra* ‘ear’; Middle Persian *srod* ‘hearing, sound’; Lithuanian *klausau, klausyti* ‘to hear’, *šlovė* ‘splendour, honour’; Old Church Slavonic *slusati* ‘to hear’, *slava* ‘fame, glory’, *slovo* ‘word’; Greek *klyo* ‘hear, be called’, *kleos* ‘report, rumour, fame glory’, *kleio* ‘make famous’; Latin *cluere* ‘to hear oneself called, be spoken of’; Old Irish *ro-clui-nethar* ‘hears’, *clunim* ‘I hear,’ *clu* ‘fame, glory,’ *cluada* ‘ears;’ Welsh *clywaf* ‘I hear;’ Old English *hlud* ‘loud,’ *hleodōor* ‘tone, tune;’ Old High German *hlut* ‘sound;’ Gothic *hilub* ‘listening, attention’. **kleu-* Proto-Indo-European root meaning ‘to hear’. It forms all or part of: ablaut; Cleon; Clio; Damocles; Hercules; leer; list (v.2) ‘hear, harken’; listen; loud; Mstislav; Pericles; Slav; slave; Slavic; Slovene; Sophocles; Themistocles; umlaut; Wenceslas; Yugoslav. It is the hypothetical source of/evidence for its existence is provided by Sanskrit *srnoti* ‘hears’, *srosati* ‘hears, obeys’, *srutah* ‘heard of, celebrated’; Avestan *sraothra* ‘ear’; Middle Persian *srod* ‘hearing, sound’; Greek *klyo* ‘hear, be called’, *klytos* ‘heard of, celebrated’, *kleos* ‘report, rumour, fame glory’, *kleio* ‘make famous’; Latin *cluere* ‘to hear oneself called, be spoken of’, *inclutus* ‘renowned, famous’; Armenian *lu*

- How do we listen with agency and intent to the environment, ourselves and each other?
- What kind of listening practices involve expansive states of focus, perception and activity?
- What kind of listening exercises involve and foster conscious attention?
- How, and to what degree, can we develop our listening capacities?
- How can we develop listening capacities such as listening to the self and other, simultaneously, for example?
- Does listening as activity incite receptivity? And if so, how?
- How can we listen for what lies beyond the horizon, for what is left out and why?
- How does listening differ from seeing?³⁶
- Is (the introduction of) listening related to a form of relationality, for which seeing is of no help?

I use Pauline Oliveros’ *Sonic Meditations* and her methodology

of *deep listening* (see the chapter ‘Aesthetic Contexts’), as well as Jean-Luc

Nancy’s remarks on *listening* (see Appendix 01 ‘Theoretical Framework’).

Both scholars place extraordinary importance on listening as a concrete, pro-active epistemological tool for modes of living socially with oneself, each other and the world.

Can we ‘learn to listen’ to a tree?

Regarding the emphasis on ‘learn to listen’ to a tree, the project

apprehends that working across disciplines also encompasses a rethinking of

the processes of not only *what* we actually learn, but *how* we learn.³⁷

Can ‘we’ learn to listen to a tree?

Within the research question ‘we’ appears as a most problematic

term and I wish to spend time on this aspect of the question; ‘we’ and its difficult discontents occur as a refrain throughout the report.

To question and critique it is so central to the project that a new term developed in its place. In the research question as it is posed, though, ‘we’ is a vague pronoun. Reading ‘we’ – in this clause that I have written and that you are reading – you might ask yourself ‘we’, who is this? Or do you adhere to this enigmatic ‘we’, seemingly addressing, involving and containing me and you and all the readers of this text? Every time I write ‘we’ and you read ‘we’, the pronoun calls for something we have in common – even if only a tiny bit of sameness. In this sense, the ‘we’ – as in ‘we know it’ – is an assumption, a presumption, a projection, a solicitation, a definition, a demand, a desire, an appeal, a call, a claim, etc. ‘We’ attracts those it sees fit to include, and by doing so excludes. The ‘we’, as we know it, does not know alterity. The only way it proposes difference is in terms of approving more than one. Since the research questions of *you are variations* directly address alterity, this ‘we’ as we know it, is unsuitable, incompatible and inappropriate. The research’s practice indeed experiences ‘we’ otherwise and proposes an alternative to ‘we’ as we know it. It is a ‘we’ not based on sameness and continuity, but a ‘we’ with an infinite affinity for difference and trust in the unknown; embodied, disembodied and re-embodied in the moments of its becoming other; in its unbecoming. It is not a pro-noun really; it does not stand for nouns or names; rather, it utters an experience of communion, accompanied by a loss of self and an attainment of a sense of connection and togetherness that leads to wholeness, experiencing unity with all and every other/s.

you are variations invented a new sign for this event – /wi/,³⁸

an experience of togetherness in and with a differential and dissimilar company of agents, human and more-than-human alike. Accordingly, this differing plural establishes difference also in its spelling and points to itself not by the written sign, but by its phoneme: /wi/. In the project it does not matter ‘how’ you pronounce it; what matters is to pronounce it: to release its sound, to enunciate it, to say it; that is: to speak. /wi/, spelled phonetically, indicates that it exists only as a sound. Instead of a concluding answer, ‘Can we learn to listen to a tree?’ leads to the sounding utterance of the felt experience /wi/.

‘known’; Lithuanian *klausau, klausyti* ‘to hear’, *šlovė* ‘splendour, honour’; Old Church Slavonic *slusati* ‘to hear’, *slava* ‘fame, glory’, *slovo* ‘word’; Old Irish *ro-clui-nethar* ‘hears’, *clunim* ‘I hear’, *clu* ‘fame, glory’, *cluada* ‘ears’, Irish cloth ‘noble, brave’; Welsh *clywaf* ‘I hear’, *clod* ‘praise, fame’; Old English *hlud* ‘loud’, *hlysnan* ‘to listen, hear’, *hleodōor* ‘tone, tune https://thednatests.com/how-much-dna-do-humans-share-with-other-animals/’; Old High German *hlut* ‘sound’; Gothic *hilub* ‘listening, attention.’ From *Online Etymological Dictionary: www.etymonline.com/word/listen*.

³⁶ See Nancy, 2002 and his notion of ‘touch’ at the base of all senses, elaborated in his online lecture ‘On Touching, Sense and Mitsein’, European Graduate School Video Lectures, 14 April 2010, <https://www.youtube.com/watch?v=ikyh2NaY4hU>.

³⁷ Education is seen here not as a product, but as a process; not as an economy, but as an ecology; one of the project’s aims and impacts is educational in this specific sense and understanding.

³⁸ This is the phonetic spelling of English ‘we’, according to the phonetic System IPA. I use the phonetic spelling to indicate, that /wi/ is always spoken and exists only when voiced, that is as a sound. It correlates with Agamben’s *La Fina del Pensiero* from 1982, where he writes: *La bestia in fuga, che ci pare di sentir frusciare via nelle parole, è — ci è stato detto — la nostra voce. Pensiamo — teniamo in sospeso le parole e stiamo noi stessi come sospesi nel linguaggio — perché speriamo di ritrovare in esso, alla fine, la voce. Un tempo — ci è stato detto — la voce si è scritta nel linguaggio. La cerca della voce nel linguaggio è il pensiero.*

[The fleeing beast, which we seem to hear rustling away in the words, is – we are told – our voice. We think – holding the words in suspense and we ourselves being suspended in language – because we hope, in the end, to find in it the voice. At one time – we are told – the voice has written herself into language. The search of/for the voice in language is (the) thought.] p. 6. And *La logica mostra che il linguaggio non è la mia voce. La voce — essa dice — è stata, ma non è più, né mai potrà essere. Il linguaggio ha luogo nel non-luogo delle voci. Ciò significa che il pensiero ha da pensare nulla della voce. Questa è la sua pietà. ...* Dunque i l linguaggio è la nostra voce, il *nostro* linguaggio. Come tu ora parli, questo è l’etica. [Logic shows that language is not my voice. The voice – it says – has been, but it is no longer, nor will it ever be. Language takes place in the non-place of the voice. This means that thought has to think nothing of the voice. This is his mercy. ... Thus language is our voice, *our* language. As you speak now, this is ethics.] p. 8. My translation.

The need to pose the question is tied to its nature – asking it goes

beyond me and beyond you as an attempt to relate to what lies beyond us. In

this project ‘beyond’ is curious and investigative and exceeds its subject matter

to see if we can realise other relations. With this there can be another ‘we’ that

does not designate and define a party, gang, group, type, nationality, class,

race, gender, sexuality, but an experience of communion; a ‘we’ – as Haraway

suggests – that ‘flourishes’, not just in our lives, but also in the lives of those

who live beyond us; a */wi/* – as *you are variations* suggests – that brings unity

and wholeness, not to the same, but to each one who differs, that is, to all.

Can we learn to listen to **alterity**?

The project explores how working across disciplines while

rethinking the processes of how we listen can broaden and deepen our

understanding of our environment and each other, ultimately enabling us

to listen and relate, communicate and act with a more informed and at the

same time more open mind. *you are variations* develops a practice of a

‘listening mind’ that locates listening in the nexus of climate, history, place,

mind and body. In composing with scientific data as artistic material, *you are*

variations creates zones of contact through which forms of *tuning in* occur,

evolving into gradual *processes of relating*, through which *listening to a tree*

becomes possible. The conclusion brings the concatenation of questions

together, outlining the project’s implications so far, and the future steps

these insights have brought about and motivate.

you are variations replies to the question ‘Can we learn to listen to

a tree?’ in the affirmative.

Another important question that came up in the writing process,

exemplifying the research as ongoing thinking process, is: When */wi/* listen to

trees, do trees listen to */ʌs/*?

Yet, a serious and vital question remains unresolved:

Why aren’t we learning to listen to trees?

We?

No, */wi/*.

– Quote from my diary, 17 August 2019

We who are not the same.

We who are many and do not want to be the same ...

... Once again: Who is we?

This is the end of these notes, but it is not an ending.

– Adrienne Rich, ‘Notes Toward a Politics of Location’, 1986

Methodology:

Ecology of Translation by Way of a Diagrammatic Notation System

There is no event or thing in either animate or inanimate nature
that does not in some way partake of language.
– Walter Benjamin, ‘On Language as Such and on the Language of Man’, 1916

Introductory Remarks

The gradual changes that characterise trees and the forests they live in can only be perceived by means of long-term, ever-more minute environmental observation. Some of the Swiss Federal Research Institute for Forest, Snow and Landscape Research WSL’s data series go back more than one hundred years. The growing urgencies and need for information on the condition and development of forests led to the UK’s National Forest Inventory (NFI) – periodically providing data since 1983.³⁹

In the 1980s, the ‘forest dieback’ (‘Waldsterben’) debate gave rise to the Sanasilva programme, a Swiss forest damage programme, and the Long-Term Forest Ecosystem Research (LWF) programme led by the WSL, from which *you are variations* gathered most of its data.⁴⁰

The LWF studies the influence of soil- and air-pollutants on the forest, as well as on the carbon, nutrient and water cycles. The recent TreeNet project continuously measures parameters related to tree growth, as well as environmental factors such as weather data. The data are measured locally, transmitted instantly and observed online. The WSL is currently developing a long-term environmental data portal, the EnviDat project.⁴¹ The LWF programme’s entire dynamic data charts collect meteorological data, soil moisture, ozone, foliar concentrations and atmospheric deposition. *you are variations* works with nine carefully selected parameters that include meteorological data, soil moisture and a selection of site-specific meta data. In an attempt to link the scientific and the aesthetic, *you are variations* turns

³⁹ See <https://www.lfi.ch/index-en.php>, resulting a.o. in the introduction of unleaded gasoline, the catalytic converter and the 120/80 km/h speed limits in Europe.

⁴⁰ The scientists store the kind of data used as basis for the compositions in the LWF Research Project’s databases, to which I am generously allowed access. See <https://www.wsl.ch/en/forest/forest-development-and-monitoring/long-term-forest-ecosystem-research-lwf.html>.

⁴¹ See <https://www.wsl.ch/en/about-wsl/programmes-and-initiatives/envidat.html>. This precious measurement series must be continued in the long-term and the data permanently archived and made available to the scientific, as well as any other interested communities in order to ensure that the measurements are interpreted and applied.

ecophysiological long-term monitoring measurements of tree activity into events of sensory experience. The project seeks to transform scientific data into tangible events and address the data’s intangibility. It does so by experimenting with different modes of sensing to reconnect data back to its referent: to specific living trees. From the sociology of science we know that data never arrives fully formed: ‘The project also stresses the fact that “data” are not [raw] events or objects but always records or descriptions or memories of events or objects. There is always a transformation or recoding of the raw event which mediates and intervenes between the scientist and the object of science.’⁴²

⁴² Data is a ‘com-putting’ of material gathered for a future interpretation, a collection for a prospective, subsequent account, planned for the production of meaning. Data is ‘feeding forward’, as Hansen remarks: ‘Data (can) acquire meaning in the future. In this sense data are potentialities. It is the abstract collection for a future potentiality.’ Bateson, 1987 [1972], pp. 3-4.

⁴³ There are artists based at the Slade, who have specifically addressed these issues through different techniques and methods. For example, Martin John Callanan’s *A Planetary Order (Global Terrestrial Cloud)*, and his collaboration with Richard Hamblin, which resulted in the publication *Data Soliloquies* (UCL Environment Institute, 2009). Thanks to Chiara Ambrosio for drawing my attention to their works.

⁴⁴ See also, Hansen, 2015, p. 268.

The project is critical of data-technicity as techno-mythology.⁴³

It questions its objectivity, its authority and its role within scientific machinery, looking at developments of sensing technology and its interplay with acts of sensing by humans, computers and trees. Western history displays nature in a particular fashion, using a scientific approach and technical aids that construct, observe and measure it. The scientific charts and diagrams that *you are variations* works with are understood as *translations* of data for the sake of a specific reading.⁴⁴

you are variations translates and arranges long-term measurements of trees as a musical score. The resulting (future) performance is conceived as the recreation of the tree as a musical event. Data is understood empirically in the etymological sense of the word, as what is given; that is, long chains of numbers related to a very narrow set of micro-events. By zooming-in musically, a change in viewpoint takes place: gradual sonic changes are subtle, and hence are powerful attention-shifters. By sharpening and intensifying our experience, *you are variations* translates the data in ways humans can perceive, mediating between the physical, scientific and aesthetic. In tying and untying micro- and macro-worlds, the project *shares* the data by turning the ‘given’ (literally: ‘data’) into ‘giving’ (literally: ‘dare’) the active present tense – this time as a common concern. In this strict sense, the data used in *you are variations* is not producing information but shifts in sensibility, intensity and participation.

In using solely scientific data, *you are variations* deals exclusively with trees as phenomena of nature in the way natural science has made them analytically accessible: a nature artificially constructed under laboratory conditions. *you are variations* is an artistic observation of science at work, in which nature appears as a kind of anthology of special effects from the virtual world relayed back into the world of our bodily senses. The project reveals natural science as a series of apparatuses, not for observing but for perceiving and thereby shaping reality, eminently co-shaping our patterns of attention, models of the environment and social structures. Data here is not improving our experience, but directing our perception.

Accordingly, *you are variations* proposes a redirection of our attention by intensifying our experience: zooming-in, amplifying, slowing down; not in a visual, computational understanding of data, but in an auditory way, proposing listening, rather than hearing. This interpretation of data engages a different sensibility that acquires an agency of its own. It brings about effects such as connection, amazement and movement: the work guides and surprises me, leading me not to reason, but to the unfamiliar, the yet-unknown.⁴⁵

If we understand the coding of data as a methodological process that directs our attention and shapes our perception, in its ‘ecology of translation’ *you are variations* de-codes and re-codes the data, taking full responsibility for it.

⁴⁵ In my experience, the work can strike several levels of consciousness at once, at times revealing connections yet to come.

An Ecology of Translation by Way of a Diagrammatic Imaginary

I make, remake and unmake my concepts along a moving horizon,
from an always decentred centre, from an always displaced periphery,
which displaces and differentiates them.

– Gilles Deleuze, *Difference and Repetition*, 1994

The processes of the tree cross disciplines. Ecohydrology, a subdiscipline of hydrology with an ecological focus, is an interdisciplinary scientific field that is the study of the interactions between water and large ecological systems. These interactions take place within blue ecosystems, such as rivers, lakes and oceans, as well as across interplays with green ecosystems, such as forests. The research done within ecohydrology also includes the interaction between planetary ecological processes and the hydrological cycle.

Climate change requires transgressing a single-disciplinary science. In ecohydrology, the water cycle through the tree that *you are variations* follows is known as the *soil-plant-atmosphere continuum* (SPAC). A continuum of interdisciplinary acts across knowledge specialisms of the Enlightenment model are researched within SPAC. Contrary to the ongoing specialisation within scientific knowledge, in *you are variations* the tree is employed the other way around: instead of pointing to the progressive diversification of knowledge in the ongoing branching off of disciplines, it explicitly points to their interlinking pattern, their potential interactions, and by doing so towards an imaginary wholeness of knowledge, a vision of knowledge inherent and accessible to all, the tree and us.

It might be important to recall and emphasise this distinction between the tree of the Enlightenment and the */wi/-tree* of *you are variations*, as it requires shifts in the conceptualisations of these tree-environments. The ‘ecology of translation’ of *you are variations* proposes an active, ongoing and generative understanding of knowledge as continuous change.⁴⁶

⁴⁶ Some of the participants I work with refer to it by using the term wisdom, rather than knowledge.

⁴⁷ Transcending (trans – *cedere*, clime across), transducing (trans – *ducere*, guide or lead across), transforming (trans – *formare*, forming), transgressing (trans – *gredere*, transmuting (trans – *mutare*, transorting, transporting (trans – *portare* = bring across), transposing (trans – *ponere* = put across), transmitting (trans – *mittere*, send across), trans-versing (trans – *versare*); they all describe a form of moving across; furthermore, *transferre* (transfer) is the Latin participle present tense of *translatus*; translate is thus derived from the past participle of *transferre*, literally: transferred. In comparison, for translate and translation German commonly uses the verb *übersetzen*, and the noun *Übersetzung*; both are not forms of past tense, but describe the activity of literally ‘setting across’ in the present tense. In Italian and Spanish, *tradurre* and *traduzione*, relate to English ‘transduce’.

The project’s transdisciplinary methodology is described as ‘composing’ by means of an ‘ecology of translation’:⁴⁷ collecting, collage, coding, drawing, grinding, interweaving, inviting, noting, noticing, programming, projecting, recording, rehearsing, rubbing (frottage), sketching, transcending, transducing, transferring, transforming, transgressing, transmuting, transporting, transposing, transmitting, transversing, writing; combined with the scientific methods I borrow from the WSL, such as soil science profiling, various techniques from dendrochronology and microscopy.

Water’s pathway – when it enters the tree from the ‘soil’, moves through the ‘plant’, leaves through gas exchange within the leaves into the ‘atmosphere’ and falls as haze, rain and snow back to the ‘soil’ – cycles in ‘continuum’, transgressing single scientific disciplines, as well as human and non-human worlds. *you are variations* conceives of the border between root and soil, as well as the border between leaf and air, as contact zones and interfaces for tree, soil and air to exchange through watery acts of communication, with root-hair and stomata as means, that is, transfiguring instruments. The transitions inherent in water’s continuous process of moving from one medial sphere into the other – speculated as a (border) work of continuously transferring information – proposes a notion of ‘transmission’ in the sense of a ‘transfer’ that entails ‘acts of translation’. Literally as past participle of the irregular Latin verb ‘*transferre*’ – to carry across – ‘translation’ (‘carried across’) gets understood and becomes identifiable in retrospect, after the actual transfer has taken place, while the very act of translation as creative act remains enigmatic.

you are variations proposes that creative acts of translation are not only extraordinary human practices, but rather that they are due to vital aquatic properties that are indispensable to life in its web of relations. In that sense *you are variations* joins the cyclical flow of water, translating from one ecosystem’s disciplinary field of knowledge into the other – from soil science to dendrochronology, from gas-exchange to meteo science, from climate data to graphs for sound, from sonic notation to the performance of music – for the sake of learning by participating in the interconnectedness of trees and their water cycle with life on earth.

To realise this I am working with a cross-disciplinary range of specialists, an array of professional and amateur musicians and one specific tree at a particular site, to see if by attending to the tree we can communicate between the different modes and ways of knowing and enable each other to listen to the tree, and by doing so, learn to listen to ourselves.

***you are variations*, an Ecology of Translation**

Transdisciplinarity, Transindividuality, Transcendence

... to form free, abstract structures
which surpass schematic intention and achieve a new naturalness,
the naturalness of the work.
– Paul Klee, *Notebooks*, 1923

The research does not deal with the nature of trees, that is, not with things-in-themselves, but with the way the trees are tied to our selves and our collective bodies. In this sense, *you are variations* is a study that treats the tree as simultaneously naturalised, socialised and visualised, as well as repeatedly reconstructed and deconstructed. In shuttling back and forth between different disciplines, between most different practices, I rely on the notion of an ‘ecology of translation’ as a folding process.⁴⁸

More supple than ‘system’, more historical than ‘structure’, more scrupulous than ‘complexity’, it is an ‘ecology of translation’ among most diverse organisms that is active in *you are variations*. There is neither a singular, mighty, all-encompassing red thread to be found, nor some sort of high-tech solution at play. Instead, there are numerous, continuously overlapping forms of translation that act as tiny fibres, giving strength to new connections.⁴⁹ Furthermore, it is the use of the newly made connection – the actual, collective and discursive relations among, across and between its practices – that are making up the creations of meaning in *you are variations*. In this complex process of ‘making sense’, from fibre to fibre, the notion of translation as used in this report is at its core. The world of meaning and the world of becoming are one and the same world, that of translation, that is a world of difference, substitution, delegation and passing. The mediation or ‘overlap’ I refer to above is an original event and ‘creates’ what it translates, as well as the entities between which it plays the mediating role: it translates, and by doing so it effects a gap, a mediation and a metamorphosis. The metamorphosis becomes

⁴⁸ Not on Latour’s notion of the network as developed in the Actor-Network-Theory, where the network is understood rhizomatically, allowing for ‘transportation without deformation’. Latour, 1993, p. 87.

⁴⁹ Wittgenstein’s proposal to understand language as a game that creates a range of meanings according to its “use” and “overlapping uses” in diverse contexts, might form an altogether different train of thought, his reasoning though can be interpreted in terms of Whitehead’s proposition to view essences as processual events.

explicable if we redistribute value to all the entities in this process of making meaning. But seen from this perspective all factors involved stop being simple, faithful, passive intermediaries. Instead they become mediators, media, that is, actors, endowed with the capacity to translate what they transport; to redefine it, redeploy it, betray it, reconfigure it, indeed: create it.

It is possible that the expanded understanding of translation in *you are variations* is inspired by Walter Benjamin. Instead of being a copy of the original, Benjamin suggests the translation of the original is its *re-creation* in the desired language. In *Die Aufgabe des Übersetzers* (1921), Benjamin uses three German words that refer to this act of translation: Übersetzung, Übertragung and Umdichtung. The English version renders the first two indifferently as ‘translation’, and the last one as ‘re-creation’. As none of these make sense, the English translation misses out entirely on Benjamin’s nuances.

In my reading, only Übersetzung can be translated into English as ‘translation’. Übertragung comes close to the English ‘transfer’ – Latin present participle of the past participle ‘*translatus*’, translate⁵⁰ – implying necessary and considerable motions and modifications, a very important concept for Benjamin.⁵¹

Umdichtung, again, is a neologism used by Stefan George for his own translations of Charles Baudelaire’s *Les Fleurs du mal: Baudelaire Die Blumen des Bösen – Umdichtungen* (1901), in *Zeitgenössische Dichter. Umdichtungen*. (1905), as well as in *Shakespeare Sonnette. Umdichtungen* (1909).⁵² In German, Umdichtung resonates with the notion of *Dichtung* – the German word for verse, poetry – meaning condensation, density, seal; when read together with the prefix *um-* and associated with the verb *erdichten*, it comes to mean falsify, fabricate, invent. Umdichtung could thus be rendered as re-fabulation, as much as ‘poetry turned-around’, ‘twisted poetry’ or ‘trans-poetry’; in any case, a ‘creative re-making’ of sorts.

According to Benjamin, every authentic translation produces not only a *re-creation* of the original, but at the same time incites the transformation and enrichment of the language it translates into. For Benjamin, the broader role and gift of translation is to reveal the inherent commune of all languages:

‘... all kinship of languages – beyond their historical relations – consists in the fact that in each one of them one thing, namely the same, is meant; but that

which is meant belongs to none of them; it is available only to the allness of each single intention when complementing each other: the pure language (die reine Sprache).’⁵³

Benjamin’s vision of a language common to all languages is not so different from the experiments of togetherness towards the experience of wholeness set up by *you are variations*. Studying the development of the project’s scoring system allowed me to link between the ecology of translation of *you are variations* and Benjamin’s differentiation between ‘translation’, ‘transference’ and ‘trans-creation’. As I attempt to explain below, what Benjamin in his text calls ‘die Aufgabe ...’ directly applies to the project’s self-assigned ‘task’ to shift the data and their meaning in myriad ways.

It is not only difficult to translate Benjamin’s essay ‘Die Aufgabe des Übersetzers’,⁵⁴ it is impossible to do so without entering into Benjamin’s concepts. The poetic element of the original cannot be preserved; it can only be actualised, and this actualisation is a work of (re-)creation. Like in the exegesis of holy scriptures, there is an immense hesitation about how to comprehend a message whose distinctive feature is that it transports no information whatsoever, no news at all, but rather requires always being given a new direction to incite interpretation. The content can hardly be called informational; it is alive, poetic and generative. Instead of focusing on its in/formative aspects, shifting content from A to B, we are offered a focus on its channelling aspects, on a guiding movement and the transformations it elicits.⁵⁵

Literaturkritik, Vom Dritten Reich bis zur Gegenwart (1933–1968), Hans Mayer (ed.), Fischer, Frankfurt 1983, S. 62. See also ‘Stefan George in Retrospect’, 1933, in Benjamin, *Selected Writings*, vol. 2., trans. Rodney Livingstone (Cambridge, MA: Harvard University Press, 1999), pp. 706–11.

⁵³ My translation.

⁵⁴ Walter Benjamin, *Die Aufgabe des Übersetzers*, in *Gesammelte Schriften* Bd. IV/1, S./pp. 9-21, Frankfurt/Main 1972. Translated as ‘The Task of the Translator’, in Benjamin, 1999.

⁵⁵ How then to create meaning with this very report, for when information, that is, data as hard facts, is not – or not only – what it conveys? How and what does this thesis incite? How does this writing speak through me – of trees – to you, by taking value from the context in which it is located, and which it simultaneously marks, questions, includes and aims to be included by?

⁵⁰ There are further noticeable differences: English uses the past participle of *transfere* for ‘translation’ – ‘set/brought across’, described not as activity in the present tense, but in retrospect as a past event that has (already) happened the moment one refers to it. German uses the present form, transfer, ‘setting across’, *übersetzten*; also preserved in the noun *Übersetzung*. In Italian and Spanish it is also an active verb in the present tense, *tradurre* – *traducir* but here the Latin root *transducere* is used, neither ‘set across’, nor ‘setting across’, but ‘guiding, leading across’. It is only the nouns *traduzione* – *traducción* that describe the act as completed in the Latin past participle *ductio*.

⁵¹ It is the term Sigmund Freud invents in his development of psychoanalysis: *Übertragung*, in English ‘transference’. He used it for the first time in 1895 in his *Studies on Hysteria*; see Sigmund Freud, *Hysterie und Angst*. Bd VI, Studienausgabe, S. Fischer, Frankfurt am Main, 1978, S. 92. Thanks to Sharon Morris for making the connection.

⁴⁵ See Walter Benjamin, *Rückblick auf Stefan George*, zu einer neuen Studie über den Dichter, in *Deutsche*

***you are variations* Ecology of Translation
by Way of Diagrammatical *Musical* Notation**

you are variations does not make use of methodologies such as visualisation or sonification, but of composing, that is, of creation. It does not strive to present ‘the real tree’ or to represent the tree ‘as it is’. It neither seeks to mirror the tree, nor resemble it. Rather, it is inspired by the tree and wishes to communicate with it. This means the data are not ‘transferred’ technologically from one medium to another with minimal translation for the sake of utmost accuracy, but rather *are* translated. An entire grammar to transpose numeric, incorporeal values into the material of sound is invented, constructed and applied. Related to this meticulous understanding of composing as an ecology of translation – a form of creation, not sonification – is the differentiation *you are variations* makes when it reads the data not as maps, but as diagrams.⁵⁶

With their measurements, the scientists I work with plot a path of selected joints at regular intervals. In joining the points of the plot to form a graph, the graph becomes a chart and concurrently gets modelled according to the research question of the scientific project. In this way the scientists interpret the data, transforming the stream of digits so that the specific arrangement of the data forms a map that reconstructs a past event. *you are variations* instead reads the scientific chart not as a map of events that happened in the past, but as an abstract line drawing, a diagram, here and now.⁵⁷

Both map and chart – etymologically related to ‘*mappa*’, cloth and ‘*carta*’, paper – refer to a surface as a device onto which to inscribe a physical trace. The tree ring could serve as an example of a challenge to the notion of the map as, in a cartographic sense, the tree rings form a map. There is no (previous) wood into which the rings are inscribed or inscribe themselves. It is the forming process of the growing rings, that make the wood.⁵⁸

⁵⁶With this I am far from wanting to introduce a false dichotomy. I base my distinction on my understanding of Guattari and Deleuze’s notion of the diagrammatic – which is in line with Sher Doroff’s *Diagrammatic Practice* from 2008, an non-representational, imaginary conception (see: <https://www.researchcatalogue.net/view/10002/10003>). Both their differentiations make it impossible to conceive of maps as a type of diagram (in my reading not even as diagrams with fixed variables, i.g.). For an extended study, see Ambrosio, 2020.

⁵⁷The study of diagrammatic praxis, following Sher Doruff’s concept of the term, focuses predominantly on the ‘*doing of diagramming*’ (Doruff, 2011, p. 3). That is to say how one re-thinks and alters perceptions through diagrams. As Doruff proposes, diagramming is a process of ‘*becoming-relational to thought*’ and ‘*the relational taking form*’ (*ibid.*, p. 3). It is an element of diagrams that warrants further investigation.

⁵⁸The difference exemplified here is between two concepts of

reality. Both of them are real enough: the map refers to a reality that is archivable and archived; the diagram to reality in its creation. Massumi's reading of Whitehead underlines this understanding, when he characterises it as an 'extreme realism', an 'incorporeal materialism', attributing abstract dimensions to reality and matter. See Massumi, interview with Arno Boehler, 'What a Body Can Do', in *Politics of Affect*, Cambridge, UK: Polity, 2015, pp. 177–04 and 'Such As It Is: A Short Essay in Extreme Realism', *Body & Society*, vol. 22, no. 1 (March 2016), pp. 115–27. It can also be qualified as 'experientialism', which distances it from phenomenology and Peirce's understanding of the diagram as 'existential graph'.

⁵⁹Whitehead, 1967, p. 71.

⁶⁰As Michel Foucault describes it in *Surveiller e punir* (1975), pp. 42–43, quoted in Deleuze, 1992, p. 35.

⁶¹According to Tom Conley, Deleuze's remarks on the diagram are close to what Michel de Certeau called the 'invention' of everyday life: '... manners of pluralising activities in ways such that given codes and laws are being bent or transgressed, because the overriding diagram includes in the formulation of its laws an integration of illegals.' See Conley, 'Mapping in the Folds: Deleuze "Cartographe"', 'Gilles Deleuze: A Reason to Believe in this World', special issue, *Discourse* 20, no. 3 (Fall 1998), pp. 123–38, <http://www.jstor.com/stable/41389502>.

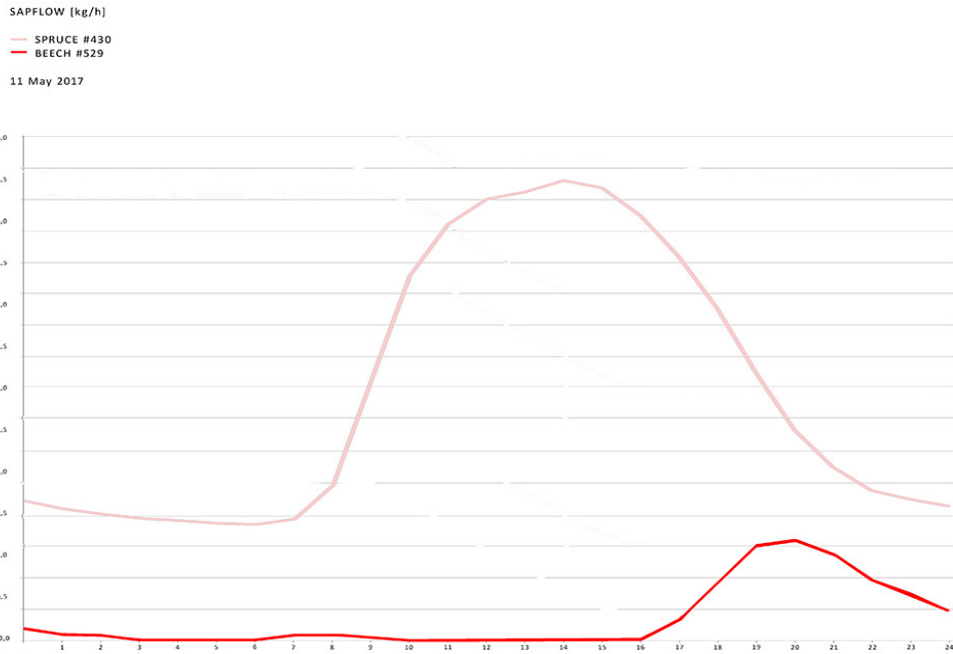
To speak with Whitehead: 'The smile spreads over the face, as the face fits itself onto the smile.'⁵⁹

While the map is allied with the power of cartographic control, and the chart with contemporary forms of locating imaging, the diagram in this report is rather understood in the Deleuzian sense as an abstract and generative engine: an instrument that is not entirely patterned according to the traditions of a pre-existing world. It produces not generality, but singularity. It draws emergent ways of living and doing – not habitus – in fashions that are connected to the future by way of 'unexpected conjunctions'.⁶⁰

For Deleuze the diagram does not sum up past behaviour. It emerges from somewhere outside, outside language, places unknown to the given language.

Unrelated to a historical or archival function, the diagram is a loose-clad configuration of possibilities that include the illegal, the transgression, what may be called 'other interpretations' of the living. *you are variation* uses such diagrammatic notation as its creative, tactical means.⁶¹

The following table might serve as an example:



Scientific chart of the amount of sapflow streaming through a Beech and a Spruce tree during one day in May 2017 at the experimental measuring plot Nacetin, CZ, respectively two different bows of tention interpreted musically by two string instruments in *you are variations*, version 08, 2017 - 2019

Reading the chart above as a *map* of past events – a representational abstraction and/or abstract representation of a specific amount of water – the chart plots measurements on the amount of sap flow in the *Spruce* (*Picea abies*, pink) and the *Beech* (*Fagus sylvatica*, red) from the experimental research site in the vicinity of Načetín in the Ore Mountains, Czech Republic, on 11 May 2017.⁶²

At the research station two forest types are present on the same bedrock and in close proximity to one another: a 70-year-old managed Norway spruce plantation and a 120-year-old European beech forest. In the research station they assess how the two forest types deal with the contaminated soil and increasing temperatures and drought.⁶³

Reading the chart above as a *diagram*, the line is read creatively, proposing a range of articulation between staccatissimo to legatissimo for the strings. In the performances in Brno and Prague the pink spruce line was played on violin and the red beech line in the first and second interpretation on double bass and in the third interpretation on cello.⁶⁴

The graph above, read diagrammatically in the way described, is in *you are variations* a conceptual, notational approach. Visually it does not differ from a scientific map, only the units of the x and y axis are altered. In the following, the same graph is shown again, this time after the collaboration with the musicians, including creative input in the interpretation of the two-dimensional line during rehearsal.

Both the map and the diagram are possible interpretations of scientific data. Data as map, however, is devoid of movement. It is a specific construction of the reading of events as evidence of happenings in a past – a past that by the plotted line is fixed and fixes it. *you are variations* interprets the scientific charts as lines in movement. They are seen as arcs of tension – *Spannungsbogen* – and are used to bring the scientifically identified event of the past back (or forward) into the here and now: *you are variations* works with measurements that scientifically account for past events of the tree,

⁶²The area shows an extreme fall in sulfur deposition – from 50 kg S (ha⁻¹ yr⁻¹) in the early 1990s, to 11 kg S (ha⁻¹ yr⁻¹) in the late 2000s, and no change in bulk Nitrogen deposition since the 1990s, an average of 10 kg N (ha⁻¹ yr⁻¹). Over the same time period, ecosystem Nitrogen leaching decreased significantly, from 20 kg N (ha⁻¹ yr⁻¹) to 1 kg N (ha⁻¹ yr⁻¹). The data are collected by Dr Filip Oulehle and his team at the Czech Geological Survey in Prague and Jiří Kučera, M.Sc from Environmental Measuring Systems EMS Brno.

⁶³At each site four replicated plots for four treatments were established: a) control treatment, b) acid treatment (as H₂SO₄, with equivalent deposition of 50 kg S ha⁻¹ yr⁻¹), c) nitrogen treatment (as NH₄NO₃, with equivalent deposition of 50 kg N ha⁻¹ yr⁻¹), and d) combined acid + nitrogen treatment (with equivalent deposition of 50 kg S and 50 kg N ha⁻¹ yr⁻¹). All treatments are applied evenly (monthly) using watering cans. Altogether, 32 plots at 2 sites were established.

⁶⁴The audio-video documentation shows excerpts from the first performance on 21 October at Theater na Orlí in Brno, Czech Republic; and the second and third performance, on 11 November 2018 and 10 October 2019, respectively, at Colloredo-Mansfeld Palace, Prague. For the list of participating musicians, see Appendix 01.

but reassembles them in such a way as to bring the tree performatively into the present. A creative understanding of diagrammatic notation is the key research method in *you are variations*.

What I want to underline here is not so much the argument that Latour, Stengers and others have outlined clearly enough – that empirical measurement as evidence of scientific truth is a specific, historical and institutional construction, and in that sense a work of fiction.

The point I wish to make is slightly different: in trying to avoid dichotomies, including that between fact and fiction, the interpretation of the line as event in *you are variations* – that is the line itself as event, not the line as document of an event in the past – opens up the possibility to read the line to create an idea, a diagrammatic imaginary.

In his article on the diagrammatic David Burrows similarly distinguishes between ‘map’ and ‘line’.⁶⁵ As much as I embrace Burrows’s distinction, I do not think that this inevitably leads to ‘different orientations of *science and art*’.⁶⁶ In this regard my reading is slightly different again.⁶⁷ I question whether it really leads to different orientations of science and art, or rather to different orientations of *technology and art*, respectively, *technology and science*. I am thus not sure if Burrows speaks about science, or about technology. Obviously, questions of interpretation and understanding of what Burrows exactly means by the terms ‘science’, ‘art’ and ‘technology’ are decisive here. But in my eyes, it can be argued that it is technology that orients itself differently than art, and not science per se. Sure, questions of minimum translation, highest precision and maximum accuracy within the contemporary scientific practices that I collaborate with concern complex technologies. It is difficult at times to even distinguish between contemporary science and their advanced technologies. However, my work with these science-partners has shown that their access to ever more finely tuned technology for the sake of observation is not their most precious asset. They too are bound to continually researching ways to interpret the data, that is, reading in a *diagrammatic* imaginary.

⁶⁵ David Burrows’s understanding of diagrammatology is developed in part from Gilles Châtelet’s *Figuring Space* (1993). See Burrows, 2014.

⁶⁶ ‘...This is a tension relating to the different orientations of science and art’, Burrows, *ibid*.

⁶⁷ *Ibid*. Burrows suggests a tension (which he calls the matheme-patheme relation) that can be explored between mathemes (lessons in structure and relations, which can be taught) and pathemes (the effects of structures and relations).

I read Burrows’s suggestion precisely in this sense: ‘... that diagrams are common throughout all university disciplines: diagramming is a trans-disciplinary practice.’⁶⁸

⁶⁸ *Ibid*. See also Ambrosio, 2020.

Maps are at risk of being updated; they actually get old. Diagrams, however, do not wear out. A diagrammatic gesture incites a motion that is inexhaustible because the gesture is generative, calling for other gestures, instead of for truth. Data as diagrams are real, collective and discursive; they are alive, visceral and utterly social. The distinction emphasises an important difference, not only in the dynamics of movement, but also in the integration of knowledge. The map always ‘knows’ what happened in the past. The diagram’s potential is for a knowledge in the now that involves us in its vortex. According to Deleuze and Guattari, intermediate space on the map indicates an overview and relation between the territories on either side of a river; in the diagrammatic world intermediate space indicates moving inside the river, back and forth, according to where things speed up: ‘The middle is by no means an average; on the contrary, it is where things pick up speed. Between things does not designate a localisable relation going from one thing to the other and back again, but a perpendicular direction, a transversal movement that sweeps one and the other away, a stream without beginning or end that undermines its banks and picks up speed in the middle.’⁶⁹

⁶⁹ Deleuze and Guattari, 1987, p. 25.

It is not the binary view, bound to point to one or the other side of the river, but the ‘transversal’ movement described here that applies to the trans-disciplinary practice of *you are variations*. It is the methodology of a practice that is not about trees, ecology or ecologies, but a practice that partakes in and co-generates an ecology, that is a process that is always ‘in the middle’. The French term *milieu* as the ‘place’ in the ‘middle’ discloses this understanding of ecology well.⁷⁰

The map is formed by journeys already made, to places already known. The diagram invites you to depart, and it only works if you embark. It is here that I suggest a further point of contact with human *and* non-human cosmologies, in which ‘the viewpoints are not outside any event, as a master viewpoint, but are at the vanishing point within the event’.⁷¹

⁷⁰ In my view, the transversal, instead of striving to reach one point or another, is in the between, a space I would like to refer to as the ‘middle’. I derive this etymologically from the term ‘milieu’: (n.) ‘surroundings, medium, environment’, 1854, from French milieu, ‘middle, medium, mean’, literally ‘middle place’ (from Latin medius, PIE root – ‘middle’) + lieu ‘place’. https://www.etymonline.com/word/milieu#etymonline_v_16153. In comparison, Uexküll’s Umwelt (from German Umwelt, see e.g.,

Umweltwissenschaften, English ‘environment’, e.g., ‘environmental sciences’), in German speaking countries has been extended in the 1960s to Mitwelt (with-world) to include not only social and cultural environments, but also human and more-than-human worlds.

⁷¹ Burrow, ‘Negative Space’, *op. cit.*

⁷² *Ibid.*, my emphasis.

⁷³ *Ibid.*

⁷⁴ Clifford Geertz also distinguishes both inscription and description from transcription, which implies taking things down, as in dictation Geertz, 1973, pp. 3–30.

Together with Burrows, we indeed propose new art-science assemblages in which ‘the *diagrammatic imaginary* and *non-human orientations of science* might be placed in productive relation with art’.⁷²

I see potential too in an art that ‘seeks new forms of presentations through a concern for the artifice of mediations, and a feel for negative space’.⁷³ However, ‘negative space’ in the experience of *you are variations* is just *one* aspect of the potential energy and significance inherent in the no-thing, the empty, the gap; it can also be perceived as the transversal, the in-between, the relational, the middle (French ‘*milieu*’, German ‘*Umwelt*’, Italian ‘*ambiente*’, English ‘environment’): at the very core of the term ‘ecology’ sits interrelatedness. It also correlates with the main methodology of *you are variations* as an ecology of translation in the revealing of relation.

Diagrammatics is the practice of making marks – that is, using drawing and inscription to note data.⁷⁴ It is common to most disciplines, while the written word is one among many other means by which meaning as mark to indicate a relation is inscribed, recorded and memorised. By way of a series of drawing projects and line experiments, *you are variations* develops a score from each data set – a score for each tree. It builds the nexus and start for an interlocking chain of experiments. Within the ecology of translation research methodology, three methods coincide with three main research phases in the project’s practice:

- Diagramming as Method 01: The Score
- Listening as Method 02: The Rehearsal
- Meeting as Method 03: The Performance

All three methods and the phases with which they coincide elicit thinking *and* acting tools in the form of practice. The practice does not create forms of representation, image, expression or mimêsis, but rather speculative, generative articulations rendering a thought process in the form of an inviting gesture towards a heightened sensibility.

Method 01 – The Score

Musical Notation as Diagrammatic

... the tree is a continuous drawing.

– Quote from my diary, 9 April 2016

In this schematic introduction to the project’s methodology, Method 01, the practice of making its mark, is of utmost artistic relevance, as the diagrams, drawings and notes leading to the musical notation described in the following section are concrete propositions for ways of making sense of and to the world.⁷⁵ Although *you are variations* is a series of sonic events, it requires writing music. ‘A history of writing must be part of a more comprehensive history of notation’,⁷⁶ writes Ingold. We make a clear distinction between (musical) notation and (written) script. Today ‘writing’ seems very different from musical notation. But how does the score differ from the script? A history of notation, including a history of writing, unfortunately exceeds the scope of this research. Nevertheless, it is important to point out that the project’s use of scientific data as material for diagrammatic thinking in the form of musical notation excludes a representational, denotational function of writing. It rather shows similarity to certain aspects of the *Event Score* as invented by George Brecht, propositional instructive texts for actions, suggesting a different musicality: ‘I tried to develop the ideas that I’d had during Cage’s course and that’s where my “events” come from. I wanted to make music that wouldn’t only be for the ears. Music isn’t just what you hear or what you listen to, but everything that happens.’⁷⁷ The Fluxus historian Hannah Higgins has declared Brecht’s *Event Score* as ‘the most durable innovation to emerge from Cage’s classroom at the New School for Social Research’.⁷⁸ It became a performance technique for the organisation of objects and actions according to chance methods, highlighting the potential and its meaning inherent within the incidental form.⁷⁹ ‘I ended up composing events rather than musical pieces’, Brecht observed in 1991.⁸⁰

⁷⁵ See also Henri Bergson’s notion of ‘duration’ and Deleuze’s work on locating the diagram within the paintings of Francis Bacon.

⁷⁶ Ingold, 2007, p. 10.

⁷⁷ George Brecht, *The Book of the Tumbler on Fire* (Los Angeles: Los Angeles County Museum of Art, 1969), p. 83.

⁷⁸ See Hannah Higgins, *Fluxus Experience* (Berkeley: University of California Press, 2002), p. 2.

⁷⁹ See *ibid.* and Brandon LaBelle, *Background Noise: Perspectives on Sound Art* (New York: Continuum Books, 2006), p. 63.

⁸⁰ Conversation with Herman Braun, Dieter Daniels and Kasper König in Cologne on 22 August 1991; printed in the un-numbered endnotes in the first volume of George Brecht’s notebooks, published in several facsimile editions; see bibliography.

The approach in *you are variations* is not based on chance, even if it cherishes ‘lucky strikes’ all along the way. Technically it is based on the contrary, on a given and finite set of very precise instructions, gathered from a specific, predescribed reading of scientific data. All nine versions of *you are variations* are fully scored graphically. In this sense the project probably shares more affinity with minimalist compositions that render singular activity within a language of musical notation and performance. However, what *you are variations* does share with the *Event Score* is the experimental quest to meet a meaningful reality inherent in every situation, every object and everyone.

Following the Soil-Plant-Atmosphere Continuum (SPAC) that is part of the water cycle through the tree, *you are variations* works with data on the tree’s sap flow gathered from three main fields of the LWF research programme:

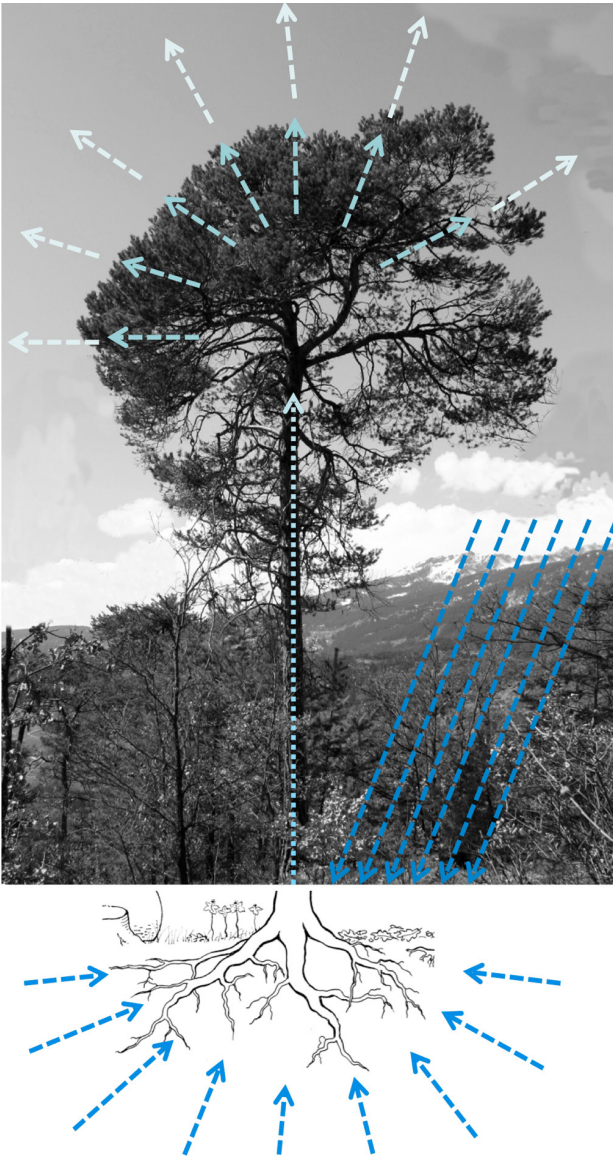


Table: Slide from lecture by
of Dr Andreas Rigling and myself,
Montreux Jazz Festival, 2015

Soil Science and the Tree’s Root System

Data on the living conditions encountered by the tree’s roots and soil organisms from soil science, such as the composition of the soil community, as well as biogeochemical water – and nutrient cycles as growth conditions for roots and microorganisms in the tree’s soil, gathered from long-term monitoring projects. Considered measured properties are:

- soil matrix chemistry
(measured by the LWF programme, 1994 – today)
- soil morphology (1994 – today)
- soil solution chemistry (1999 – today)
- composition of ground vegetation (1994 – today)
- litterfall (1996 – today)
- deadwood sampling (2009)

Dendrochronology – Wood, the Stem and Branching of the Tree

The WSL’s tree-ring analysis lab is the largest in Europe and the second largest worldwide. The data gained from ring width, maximum latewood density and isotopes are assigned to the tree’s growth year to measure the impact of environmental conditions on wood anatomy and physiological processes, and to reconstruct vegetation history. By dating climate variability over millennia, the tree-ring lab contributes to local and global climate models. Considered measured properties are:

- tree cores (1998)
- tree diameter and height (2000 – today)
- manual circumference band (2001 – today)
- point dendrometer (2011 – today)

Gas Exchange Between Carbon, Oxygen and Water – the tree’s Canopy and Leaves

Environmental conditions regarding the gas exchange between leaf and atmosphere, respectively, how the water leaves the tree and re-enters the atmosphere, are monitored by the WSL’s LWF programme.

Considered measured properties are:

- atmospheric deposition (measured 1996 – today)
- crown condition (1995 – today)
- crown transparency (1995 – today)
- leaf chemistry (1997 – today)
- leaf area index (1996 – today)
- ozone symptoms (2002 – today)
- ozone concentration (2000 – today)

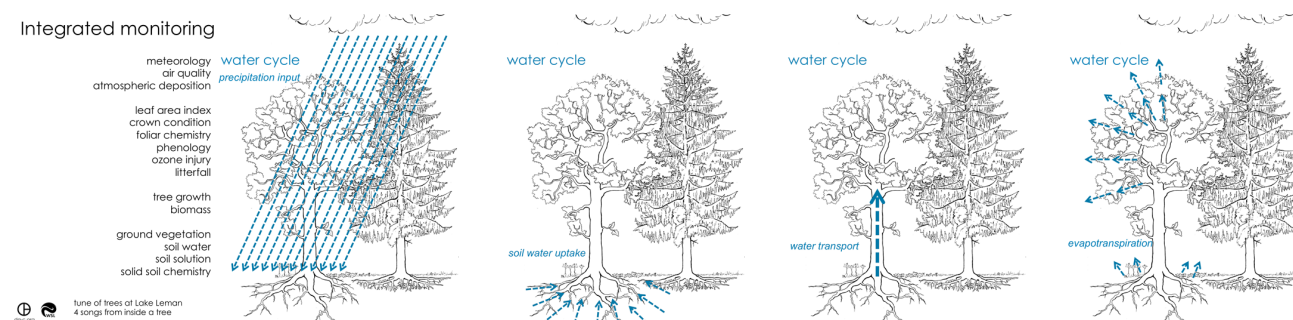


Table: Slides from lecture of Prof Dr Andreas Rigling and myself, Montreux Jazz Festival, 2015

Additional to these three area's of research at the WSL, which focus on the three sections 'root', 'stem', leaf', meteorological data from the close-by neighbourhood are included, since the immediate environment around the tree greatly cooperates in the tree's sap flow.

The following table schematically shows the flow of data based on an example for meteorological data. It indicates the data transfer from the field to the final scientific product (including quality control).

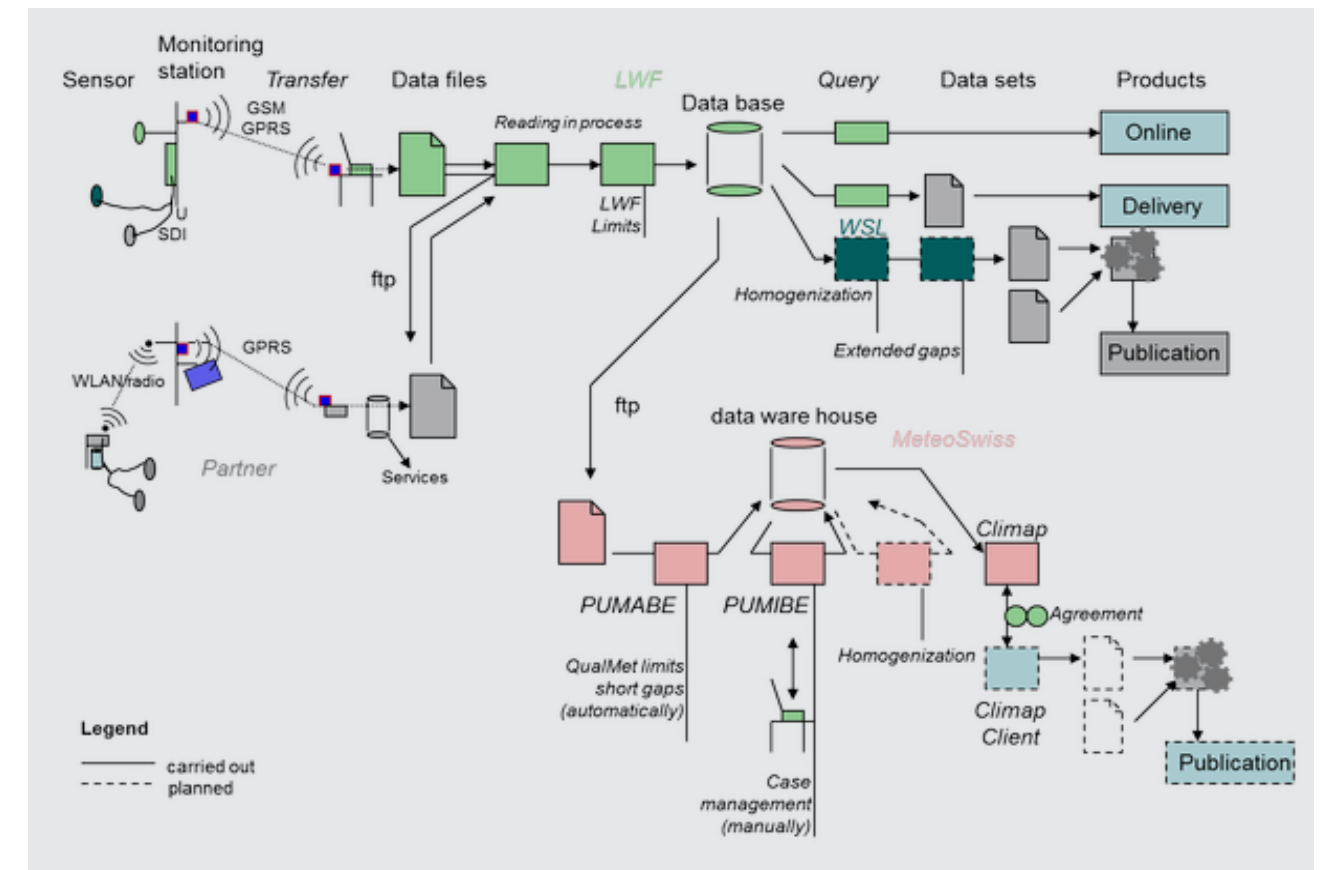


Figure: P. Waldner, WSL⁸¹ See <https://www.wsl.ch/en/forest/forest-development-and-monitoring/long-term-forest-ecosystem-research-lwf/data/data-flow.html>.

From all meteorological properties measured by the LWF programme, in consultation with the scientist involved, you are variations considers the following nine calculations:

- soil water content (2010 – today)
- soil matric water potential (1996 – today)
- sap flow (1996 – today)
- evapo-transpiration
- global solar radiation
- air temperature
- air humidity
- wind speed
- wind direction

The following is an exemplary musical interpretation of eight climate properties, showing the way they are assigned to *you are variations*, version 04's acoustic instrumentation and articulation (performed by five musicians at Montreux Jazz Festival in 2015):

from scientific data to musical interpretation

list of parameters:

air temperature [C°]	tremolo [rapid reiteration, <i>oud</i>]
relative humidity [%]	dynamics H ₂ O [amplitude, <i>oud</i>]
precipitation [mm]	articulation H ₂ O [<i>oud</i> , <i>flute</i>]
wind speed [m/s]	dynamics [<i>oud</i>]
global radiation [W/m ² /s]	tempo [bmp, <i>tutti</i>]
photosynthetic active radiation [micro mol/m ² /s]	articulation [<i>cell</i>]
evapotranspiration [mm]	breath H ₂ O [<i>flute</i>]
soil humidity [mm]	dynamics H ₂ O soil [amplitude, <i>marimba</i>]

tune of trees at Lake Lemman - 4 songs from inside a tree

soil	marimba	Dieter Buchwalder
tree wood	cello 01	Désirée Senn
	cello 02	Dominique Zimmermann
tree water	flute	Ruedi Linder
atmosphere	oud	Christian Moser

dig-c.org



Table: Two slides from lecture by Prof Dr Andreas Rigling and myself, Montreux Jazz Festival, 2015

you are variations relates each scientific parameter to a corresponding sonic parameter, which together lead to the artistic concept, the musical scores and the live performances. This assembly of the differing systems – aggregating scientific, organisational, compositional and instrumental cultures and contexts that are foreign to each other – is understood as ‘composing’. The setting up of correspondences is understood as ‘translating’, and the web of translations as ‘ecology of translation’, employed according to the following main guidelines:

- the tree as organism is translated into a composition; all the data chosen, building a scientific statement of organisation, are translated into a musical *score as consecutive statement of organisation*
- scientific long-term monitoring data is read as artistic material (weather data in the form of *scientific charts* are translated into *graphic musical notation*)

- energy circulation is read as index of the overall timing (*global solar radiation* is translated into *tempo*)
- the periodic table is read as musical scale (translation into *sound frequencies*) (physical properties of the chemical *elements* are translated into *hertz, pitch*)
- *molecular formula and molar concentration* is read as *metric structure* (the molecules’ form is translated into *rhythm*)
- meteorological data is additionally read as instructions for instrument-specific articulations (weather data are translated into *gestures for wind instruments*)
- dendrochronological data is additionally read as instructions for instrument-specific articulations (wood data are translated into *gestures for string instruments*)
- soil cycling data is read as additional instruction for instrument-specific articulations (wood data are translated into *gestures for percussive articulations*)

you are variations gives voice to the scientific data by means of a three-step process:

- A – which tone (ratio/frequency/pitch)
- B – in what kind of tempo and timing (periodicity/rhythm)
- C – through what kind of sonorities (timbre/articulations/instrumentation):

⁸² For the formula used to calculate the pitch of each element in the periodic table, see the following pages.

A – The circulation of matter within the tree defines the sounds’ *pitch* according to the specific reading of the modern periodic table of elements as a musical scale in *you are variations*, whereby each element is correlated with a single note (frequency/hertz).⁸²



H



O

Examples: Hydrogen (H) = 816 Hz, Oxygen (O) = 268 Hz
H₂O is interpreted as the interval: Hydrogen (H = 816 Hz) and Oxygen (O = 268 Hz)

B – The molecular configuration of the tree’s circulating energy and matter is interpreted as *rhythmic structure*.



H2O

Example: H₂O is interpreted as two counts Hydrogen (H = 816 Hz) and one count Oxygen (O = 268 Hz)



H2O



O2



C

Examples: H₂O, O₂, C in the soil (Lausanne)
played by marimba



SiO2



CaCO3



CaAl2SiO8



KAlSiO8



NaAlSiO8

Examples: salts in the soil (Lausanne)
played by marimba



O2



H2O



N2

Examples: air (atmosphere, Lausanne)
played by wind instruments

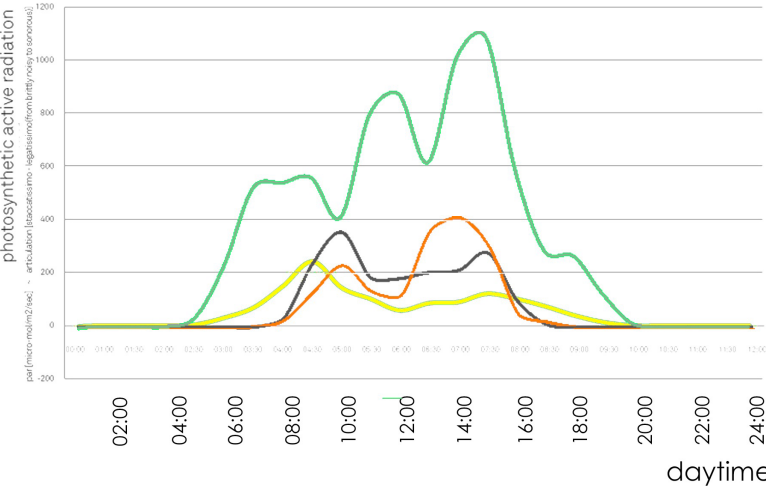
C – The environmental data of the tree’s immediate surrounding – in contemporary life science used in the form of graphical charts – are interpreted as ‘Spannungsbogen’, a German expression (literally ‘bow of tension’) that is a sequence of events that serve to allow tension and/or suspense for diverse, specific musical articulations to arise. They determine *how* to perform individual notes within a phrase or passage: the direction and performance technique that affects the single note or the transition between multiple notes. In doing so they underline and emphasise specific ecophysiological or meteorological events.

The climate data are distributed among the acoustic instruments by specifically selecting and pairing data properties with instrument properties (such as materiality, sounding technology, size, timbre, etc.), while the electronics play all environ-specific data, except ‘global solar radiation’ – the amount of energy and information coming from the sun – to avoid a karaoke effect.

Global solar radiation is usually played solely by the marimbaphone.

In the following are some examples:

Global solar radiation -interface to atmosphere



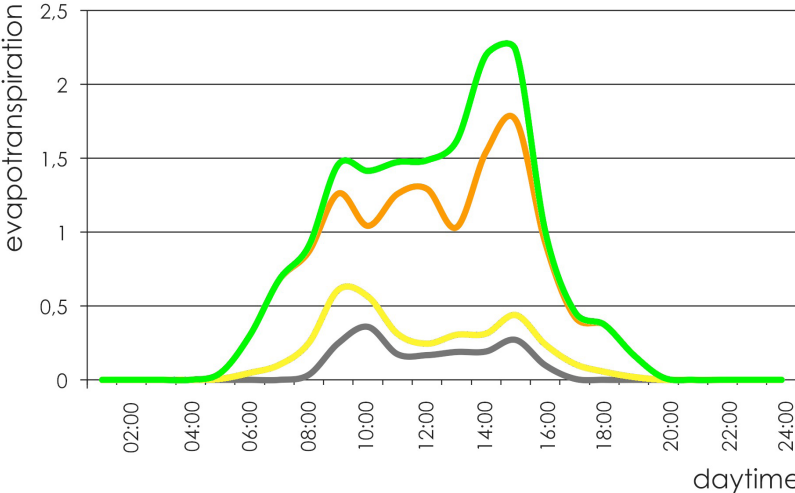
2011
 october 09
 july 06
 may 12
 january 20



tune of trees at Lake Lemman
 4 songs from inside a tree

Example: The global solar radiation as measured on the upper surface of the tree’s leaf (W/m²) is read as time signature/metre of the music, which is the overall tempo (bpm).

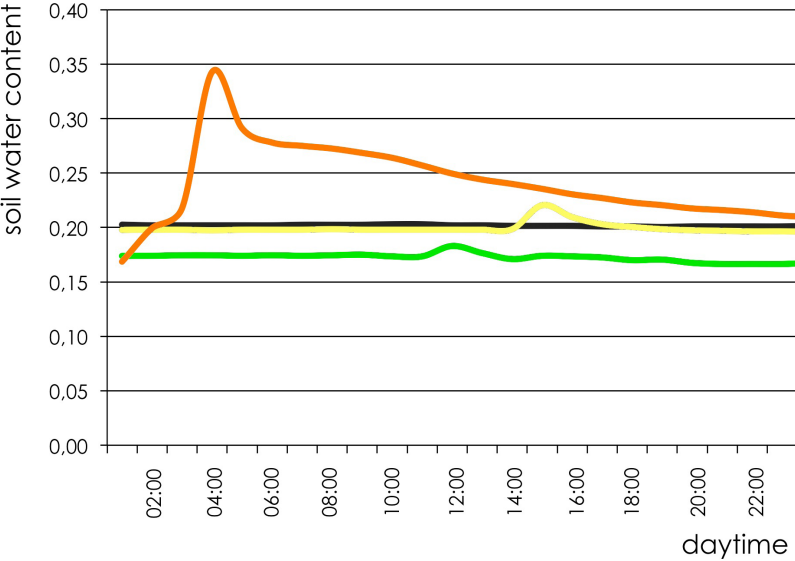
evapotranspiration: interface to atmosphere



tune of trees at Lake Lemman
 4 songs from inside a tree

Example: Evapotranspiration (ET) by the strings is read as range between staccatissimo and legatissimo

soil water content: water as basis of tree growth



tune of trees at Lake Lemman
 4 songs from inside a tree

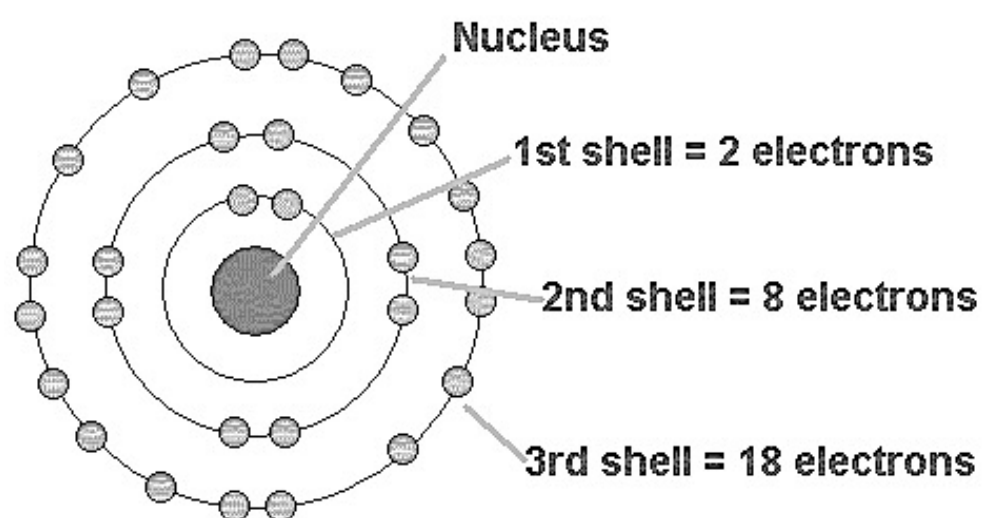
Example: Soil water content (cm³/cm³) by the strings is read as dynamic range between from pianissimo to fortissimo

A – The Element-Pitch Relationship Set-up

The chemical elements constituting the tree, and with it all living matter, are heterogeneous and very complex, but in general are composed of just four elements. The acronym CHON stands for the four most common elements in living organisms: carbon, hydrogen, oxygen and nitrogen. Living organisms are built predominantly from these four non-metal elements, even if homeopathic trace amounts of many metal elements are essential for trees as much as for us. CHON are very small and highly reactive chemical elements. Each of the four elements has a characteristic valence that determines the number of covalent bonds it can form.⁸³

Chemical reactions involve the rearrangement of electrons. Nuclei of atoms (protons and neutrons) usually remain unchanged (except in radioactive decay). Electrons are arranged in atoms according to their energies. This is called the electronic structure or electronic configuration of the atom. A crude but still used model has it that the electrons can be in different energy levels. Electrons in a particular energy level all have the same energy as one another.

A simple definition of Bohr's atomic model is:



Electrons orbit the nucleus at set distances. When an electron changes orbits, it does so in a sudden quantum leap.

The energy difference between the initial and final orbit is emitted by the atom in bundles of electromagnetic radiation called photons.⁸⁴

⁸³ The ability for an atom to combine with other atoms depends on the number of electrons in the outer shells of the atoms. Like many elements, also CHON will share electrons with other elements, such that each element completes its outer electron shell capacity. A shared electron pair is called a covalent bond. The number of covalent bonds that each element can form is called its valence.

⁸⁴ See <https://sites.google.com/site/comerschemistryclassroom/useful-links/bohr-s-model-2>.

The lowest energy level can accommodate up to 2 electrons.

Hydrogen with a valence of 1 electron belongs to this group. The second level can accommodate up to 8 electrons. All three elements oxygen, nitrogen and carbon belong to this group of electron shell. C, O and N are listed in the periodic table in the d-block.⁸⁵

:

- Carbon has 4 electrons and a valence of 4 electrons
- Nitrogen has 5 electrons and a valence of 3 electrons
- Oxygen has 6 electrons and a valence of 2 electrons

Atom	Hydrogen	Oxygen	Nitrogen	Carbon
Valence	1	2	3	4
Model				

⁸⁵ See http://www.phschool.com/science/biology_place/biocoach/biokit/valence.html.

Thus, atoms of elements combine, but only at certain fixed ratios.

The ratios are determined by the combining power of atoms:

- Carbon has a combining power of 4,
which means each carbon atom can form 4 bonds
- Hydrogen has a combining power of 1,
which means each hydrogen atom can form 1 bond
- Oxygen has a combining power of 2,
which means each oxygen atom can form 2 bonds
- Nitrogen has a combining power of 3,
which means each nitrogen atom can form 3 bonds

Where does this number come from? The combining power is the number of electrons in an atom that can be used to form chemical bonds. When one atom bonds to another it is these available electrons that are involved, that is, those in the outermost electron-containing energy shell. When atoms bond, they usually achieve a more stable electronic structure. The atoms making up the tree are held together in compounds by chemical bonding to 8 electrons. When these atoms bond to one another there is a rearrangement of

⁸⁶The tree’s compounds fall into two types: inorganic compounds, e.g., water (molecules) and salts (with ions such as potassium, calcium, etc.); organic compounds, e.g., carbohydrates, lipids and proteins (all of which exist as molecules). Organic compounds can be recognised from their formulae – they all contain the element carbon.

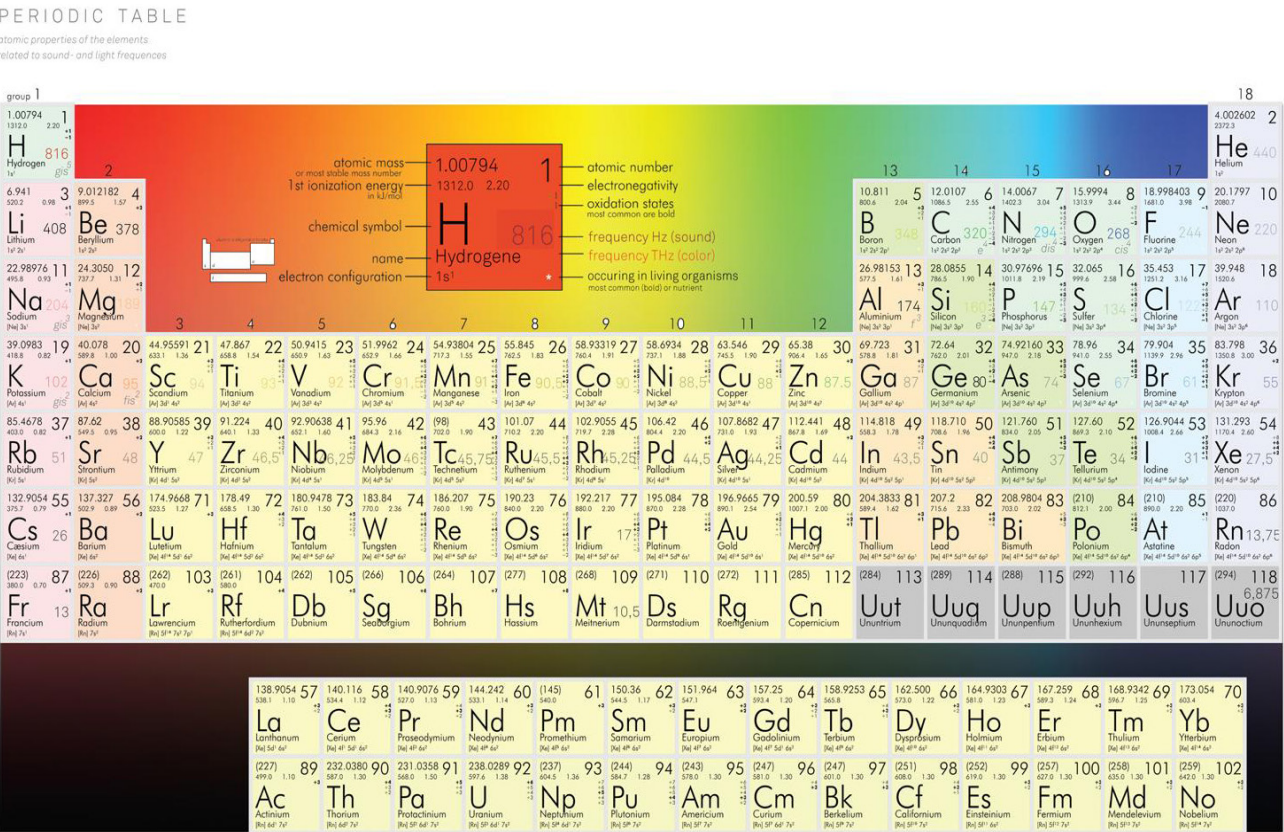
⁸⁷In the case of helium, its shell contains 2 electrons and does not bond; neon’s outer shell contains 8 electrons; it does not react or bond.

the 8 electrons and the particles present in compounds are no longer atoms, but ions or molecules.⁸⁶ They show new, emergent properties, different from the properties of the individual elements. Life can be seen as an example of an emergent property that arises from the bonding necessity of very small, unstable atoms and the specific constellation of molecules found in cells. In contrast, the outer shells of the inert or so-called noble gases are completed and do not share electrons.⁸⁷ In the periodic table they are listed as a group in column 18, while H, N and O are in the same 2 rows of the table, in period 1 and 2 respectively. One could argue that life’s constituents H, C, O and N are bound to bond to become stable. They are highly reactive and they all look to complete their outer shells with 2, respectively 8 electrons in total: in the case of hydrogen the electron amount of the noble gas helium (2), in the case of carbon, oxygen and nitrogen, that of neon (8), which are fulfilled and do not bond.

If to allow for an imaginary analogy between life and a musical piece, one could say that CHON strives for a base chord root, the rule of 8 electrons, that in their periodicity is achieved by the first noble gas helium. *you are variations* relates this rule of 8 electrons to the 8 tones within the octave as main chord structure in the Western musical scale. As aesthetic decision in reference to this Western musical canon, I made the deliberate choice to assign a frequency to helium and call this chord root 440 Hz, or helium = A4. 440 Hz corresponds to concert A pitch (the A above middle C on the piano), which is the modern standard for most Western acoustic and electronic music. Furthermore, it allows one to calculate all elements cycling through the tree within the realm of human audible reach. Consequently, the column of the noble gases is set as octaves of 440 Hz, that is, neon = 200 Hz, argon = 110 Hz, etc. The octave is chosen as reference to the rule of 8 electrons in the outer shell of CHON. This periodicity works as reference to calculate the pitch of each element in the periodic table, distributing the octave proportionally according to the Gaussian function, whereby the atomic weight is taken to calculate the standard deviation (root mean square).

In this way *you are variations* calculates and assigns a frequency to each element in the periodic table, for CHON these are:

- Carbon = 320 Hz
- Hydrogen = 816 Hz
- Oxygen = 268 Hz
- Nitrogen = 294 Hz



Key to microtones in *you are variations*
December 2011 – present

sound frequencies (in Hz) according to the atom’s period/group position indicated next to the atom’s abbreviation light frequencies (in THz) according to the atom’s group/row position indicated by the background colour

The periodic table of the chemical elements is ubiquitous within academic disciplines of the natural and life sciences, providing the framework to classify, systematise and compare the behaviour of matter. It is the vocabulary scientists use to name and share their findings and the nomenclature with which they communicate their measurements with me. According to chemist and philosopher Eric R. Scerri the periodic table is one of the most powerful icons in science.⁸⁸

⁸⁸In *The Sciences*, <http://www.scientificamerican.com/article/the-evolution-of-the-periodic-system>. Scerri’s *The Periodic Table* (Oxford: Oxford University Press, 2006), is a useful reference.

⁸⁹ See, for example, Peter Armbruster and Fritz Peter Hessberger, 'Making New Elements', *Scientific American*, September 1998, <https://www.scientificamerican.com/article/making-new-elements/>.

The periodic system for classifying elements can be traced back over 200 years – a long history throughout which it has been disputed, altered and improved as science itself was modified.⁸⁹ The layout of the table has been refined and extended over time, as new elements have been discovered, and new theoretical models have been developed to explain chemical behaviour. Yet despite the changes that have taken place in science in the last century, namely, the development of the theories of relativity and quantum mechanics, there has been no alteration in the basic nature of the periodic system. The periodic table remains notable both for its scientific history and for its scientific relevance.

In the context of *you are variations*, it is a most curious coincidence and therefore relevant to note, that in 1864 the English chemist John Alexander Reina Newlands suggested any element arranged in order of atomic weight showed properties similar to those of the elements eight places ahead and eight places behind on the list, which he called the *Law of Octaves*. As we shall see, the fact that three of the four elements of most organic compounds – hydrogen, carbon, oxygen and nitrogen – belong to the group of atoms with eight electrons in the second shell, is key for *you are variations* reading of the periodic table as a musical scale that is ordered in octaves. Newlands too compared the periodic similarity between the elements with the octave in Western music, where every eighth note in circularity of pitch resonates fully with the first or fundamental, and proposed the *Law of Octaves* in his 'periodic table' from 1865, linking chemistry and music:

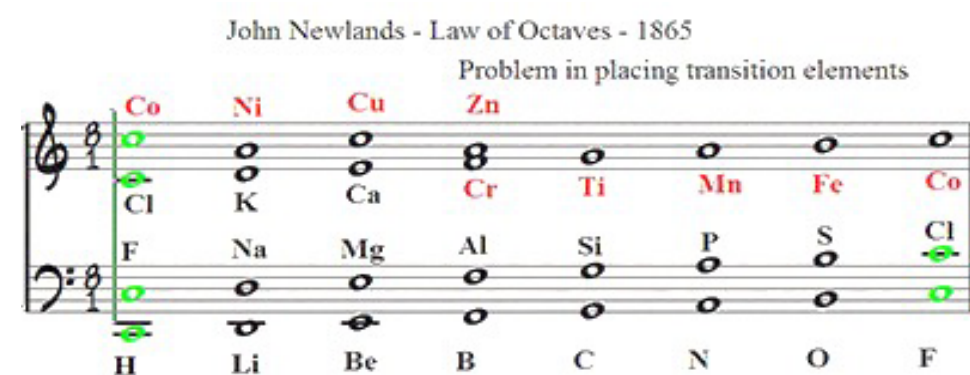


Figure: Newlands, 'On the Law of Octaves', *Chemical News* 12 (1865), p. 83. <http://www.soci.org/news/london/big-band-2014>, https://www.meta-synthesis.com/webbook/35_pt/pt_database.php?PT_id=8

Nowadays Newlands's work is considered to represent the first time anyone used a sequence of ordinal numbers to organise the elements. In this respect, he anticipated the modern organisation of the periodic table based on the sequence of so-called atomic numbers. However, his method of classifying elements failed when he reached the transition elements and met with a lot of resistance in the scientific community. His work was ridiculed when presented and not published by the Chemical Society. Only in 1889, upon his death, did the Royal Society of Chemistry concede Newlands's contribution.⁹⁰

Newlands's notion 'periodic' indicates that in their properties the elements show patterns in regular intervals. It inspired the work not only of chemists but also of atomic physicists.⁹¹ Niels Bohr was the first to bring quantum theory to bear on the structure of the atom. In Bohr's model of the atom,⁹² developed in 1913, electrons inhabit a series of concentric shells that encircle the nucleus. Bohr reasoned that elements in the same group of the periodic table might have identical configurations of electrons in their outermost shell and that the chemical properties of an element would depend in large part on the arrangement of electrons in the outer shell of its atoms. Bohr did not derive electron configurations from quantum theory but obtained them from the known chemical and spectroscopic properties as listed in the periodic table of the elements. The modifications to quantum mechanics made by Werner Heisenberg and Erwin Schrödinger in the mid-1920s have not notably altered the periodic table.⁹³

you are variations treats the periodic table as a communication interface in its dialogue with the scientists who engaged in this collaboration, and as a main referent, reading it as a scale and consequently uttering it in another language, that of music.

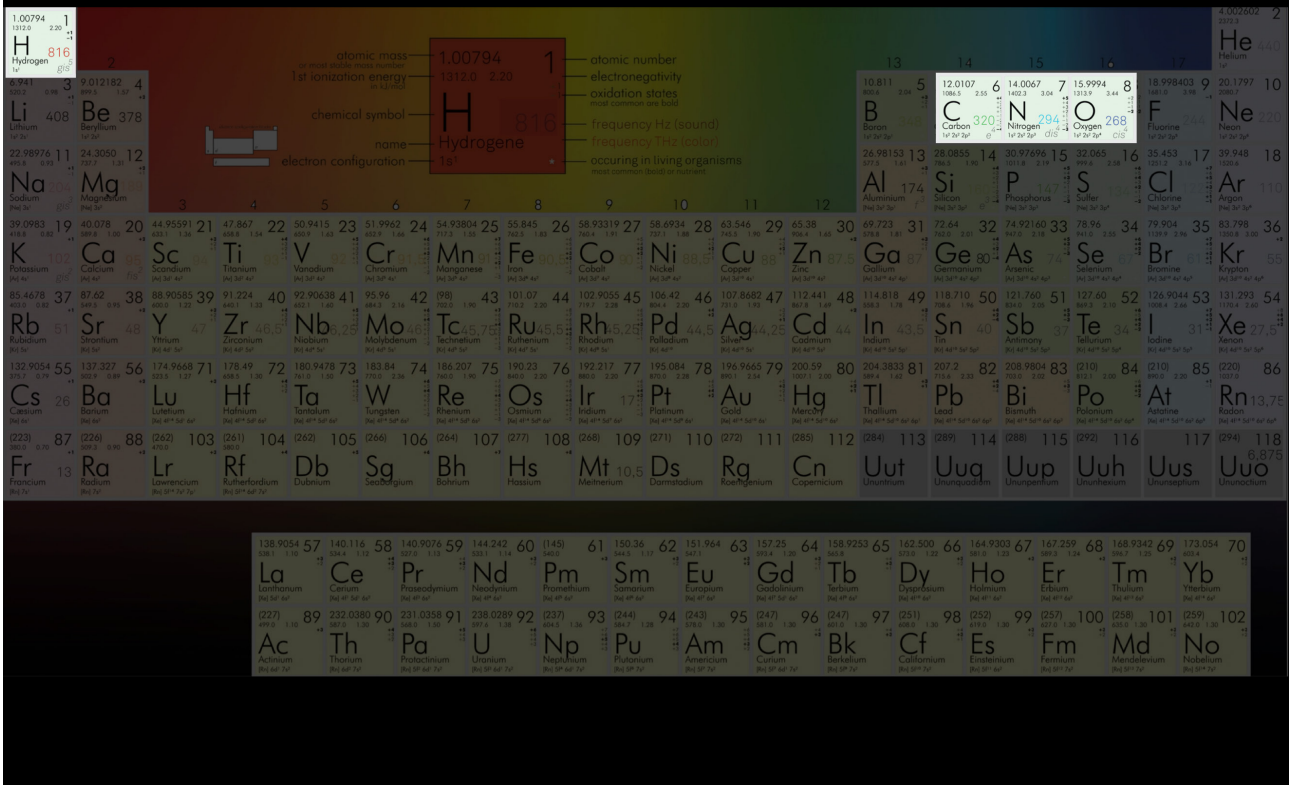
⁹⁰ The reason for rejection of Newlands's paper, given by the president of the Chemical Society, William Odling, was that they made a rule not to publish theoretical papers, and this on the quite astonishing grounds that 'such papers lead to a correspondence of controversial character'. Giora Shaviv, *The Synthesis of the Elements* (Berlin: Springer-Verlag, 2012), p. 38. A plaque placed on the wall of his birthplace by West Square in South London states: 'Newlands, chemist and discoverer of the periodic law for the elements.'

⁹¹ In 1904, physicist J. J. Thomson, the discoverer of the electron, developed a model of the atom that pays attention to the periodicity of the elements. See Scerri, *op. cit.*

⁹² Here in common English the term 'model' is used for design, configuration, mode.

⁹³ See Scerri, *op. cit.*

periodic table of the elements



B – The Molecule-Rhythm Relationship Set-Up:

The chemical composition of wood varies from species to species, but is approximately 50% carbon, 42% oxygen, 6% hydrogen, 1% nitrogen and 1% other elements, mainly calcium, potassium, sodium, magnesium, iron and manganese. Wood also contains sulfur, chlorine, silicon, phosphorus and other elements in very small quantities. It means *you are variations* works in minimal ways with the 4–9 tones assigned to these 4–9 elements.

Aside from water, wood has three main components: cellulose ($C_6H_{10}O_5$) constitutes about 41–43%.⁹⁴ Next in abundance is hemicellulose ($C_5H_{10}O_5$), which is around 20% in deciduous trees and 30% in conifers. It is mainly five-carbon sugar that is linked in an irregular manner, in contrast to the symmetric cellulose. Lignin ($C_{31}H_{34}O_{11}$) is the third component at around 27% in coniferous wood versus 23% in deciduous trees. Lignin confers the hydrophobic properties reflecting the fact that it is based on aromatic rings. Furthermore, wood consists of a variety of low molecular weight organic compounds, called extractives. The wood extractives are fatty acids, resin acids, rosin, waxes and terpenes. All these interwoven components are played by three or two strings. How their play of the continuous samples of different formulas brings about a rhythmic phasing is outlined exemplarily in the following:

⁹⁴A crystalline polymer derived from glucose.

In the slide above the four elements comprising the main composition of the tree as matter are highlighted.

Carbon, Nitrogen and Oxygen are very small, unstable atoms, belonging to the group that strive to contain 8 electrons in the outer shell to be stable. In their group, the inert nobelgas Neon, saturated with 8 electrons in its outer shell, is stable. The fact that Neon is stable, while the elements C, N and O strive to become stable, inspired *you are variations* to assign a base frequency to Neon, and in octaves respectively to Helium, Argon etc., while calculating the frequencies of the other atoms in the group according to their atom's mass. As base frequency, I deliberately decided to use 440 Hz. For Helium then I calculate 880 Hertz, for Argon 220 Hertz, and for the atoms Carbon, Nitrogen and Oxygen 320, 294 and 268 Hertz respectively.

It is due to the fact that the main elements of organic chemistry are very small atoms that strongly strive towards 8 electrons that the association with the octave in music came about, and with it the idea to read the periodic table as microtonal musical scale.



C6H10O5
cellulose



C5H10O5
xylose



C9H10O2
lignin

In you are variations, version 08, interpretations 01 - 03
we experimented with combinations of the following instrumentation:

- cellulose-sample played by double base / cello
- xylose-sample played by cello / violin
- lignin-sample played by violin / cello

The molecular structure is taken as rhythmic instruction by
counting the atoms bonding as count: that is, the bonding of the atoms provides
the count for the rhythm:

H_2O = 2 counts (of 816 Hz), followed by 1 count (of 268 Hz).

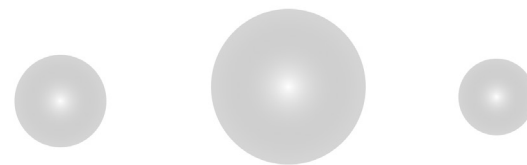
The resulting rhythm is:



For the three main components comprising the spruce's wood at Načetín, i.g.,
this means:

Cellulose ($\text{C}_6\text{H}_{10}\text{O}_5$) = 6 counts (of 320 Hz), followed by 10 counts
(of 816 Hz), followed by 5 counts (of 268 Hz).

The resulting rhythm is:



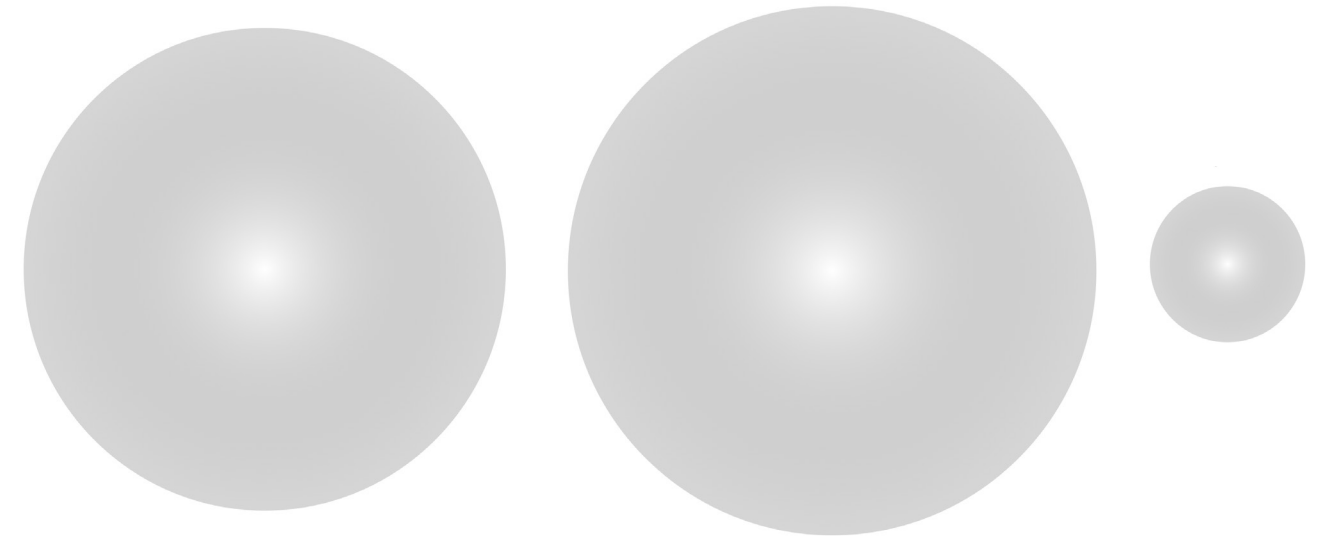
Hemicellulose ($\text{C}_5\text{H}_{10}\text{O}_5$) = 5 counts (of 320 Hz), followed by 10 counts (of 816 Hz),
followed by 5 counts (of 268 Hz).

The resulting rhythm is:



Lignin ($\text{C}_{31}\text{H}_{34}\text{O}_{11}$) = 31 counts (of 320 Hz), followed by 34 counts (of 816 Hz),
followed by 11 counts (of 268 Hz).

The resulting rhythm is :



Side Note on the Relevance of Rhythm and Timing in Deep Time

‘There is a rhythm of process whereby creation produces natural pulsation,

each pulsation forming a natural unit of historic fact.’

These ‘transitions of history exhibit forms of order.’

‘The essence of life,’ however, ‘is to be found in the frustrations of established order.

Its ‘aim is at novelty of order.’

– Alfred North Whitehead, *Modes of Thought*, 1938

Modernity differentiates old from new, past from future, regress from progress. Time moves forward endlessly. The past is seen as chaotic confusion of nature, things and men; the present as mandatory labelling, sorting and cleaning of the categories and their functions; and the future as a state of efficient order, devoid of any messy, shapeless commotion and disorder, and also from any formless void. Deleuze asks: ‘What is the source of the very modern impression that we are living a new time that breaks with the past? Of a liaison, a repetition that in itself has nothing temporal about it?’⁹⁵

The question that Deleuze raises, when he asks, ‘Where did we get the idea of time passing from?’ points to the modern conception of the passing of time as a particular form of linear historicity.

⁹⁵ Deleuze, 1994 [1968], quoted in Latour, 1993, p. 75

I would like to propose the following alternative hypothesis: it is motion – our own, a *moving along* of some sort – that brings about time, not time that causes the movement. There is a most curious ‘freedom’ in this movement. It is the paradoxical freedom to move together with My argument is that we are provided with limited ways of thinking about relationality; it is the very connection among beings and the world – among me, you and the tree, among us – that crafts time. In this sense, the entire process *you are variations* comprises can also be seen as a means to unpack data with the aim to release and give back time. What I mean by ‘unpacking data’ as a way of ‘giving back time’ is to read data as condensed time within a relational framework. When the abstraction the data comprises is re-situated in

a concrete, actual context, the relations bringing about the data are revealed and the time distilled gets released.

Along these lines I realise we cannot experiment with alternatives to modern dualism without basic modifications of our attitude towards time. What are alternatives to conceptions such as ‘my time’, ‘your time’, ‘our time’? What are their rhythmicities and synchronicities? What is the scope of temporalities we are dealing with when we think of the tree?

Intercultural studies allow knowledge of the passage of time conceived in other ways: as cycle, wheel, fall, continuous presence, song, etc. These conceptions are mostly structured in cycles on a large and small scale. Let us, as an example, suppose we are going to regroup this writing in concentric circles along an imaginary spiral wheel. Elements that appear remote may turn out to be quite nearby. Conversely, elements that are quite novel, if we judge by the line, become remote when we traverse one wheel’s spoke. In such a framework, our actions can be understood as poly-temporal. Latour suggests calling the different interpretations of this ‘passage’ our ‘passing’ *temporalities*.⁹⁶ The idea that the past remains, and even returns, perhaps cyclically, is a suggestion for a different temporality.

In musical tempo, time is an indispensable agent: What do modulations of pulse do to our experience? What does the recurrent motive of repeating a musical theme in regular intervals cause? Or even more comprehensively: What does it mean to ‘play together’? To ‘start together’? Isn’t it the creation of and agreement to a fictive zero time? An imaginary centre that creates a reference point for a circle of participants and events to unfold, refold and meet? Furthermore, acoustically and orally we can perceive a high degree of complex concurrence, synchronicity and layering in a simple event, as well as disarray in linear time through experiences of anticipation, intuition, delay, echo, retrospection, etc. These modulations resist what we habitually call clock time, refuse solely linear thinking and summon alternatives.

At the WSL the scientists work with remnants of a larch in the Russian Altai Mountains that has been growing since the first millennium after Christ.⁹⁷ The urgency to imagine ‘tree time’ in light of our present-day climatic concerns leads *you are variations* to play with the trees’ time, neither in reckless negligence, nor in abstract, distant prospect, but experimentally, curiously and in concert with the trees.

⁹⁷ See <https://www.cam.ac.uk/research/news/amount-of-carbon-stored-in-forests-reduced-as-climate-warms>.

The queen of rhythm, syncope is also the mother of dissonance;
it is the source, in short, of a harmonious and productive discord ...
Attack and haven, collision; a fragment of the beat disappears,
and of this disappearance, rhythm is born.
– Catherine Clément, *Syncope*, 1994

⁹⁶ Latour, 1993, p. 68.

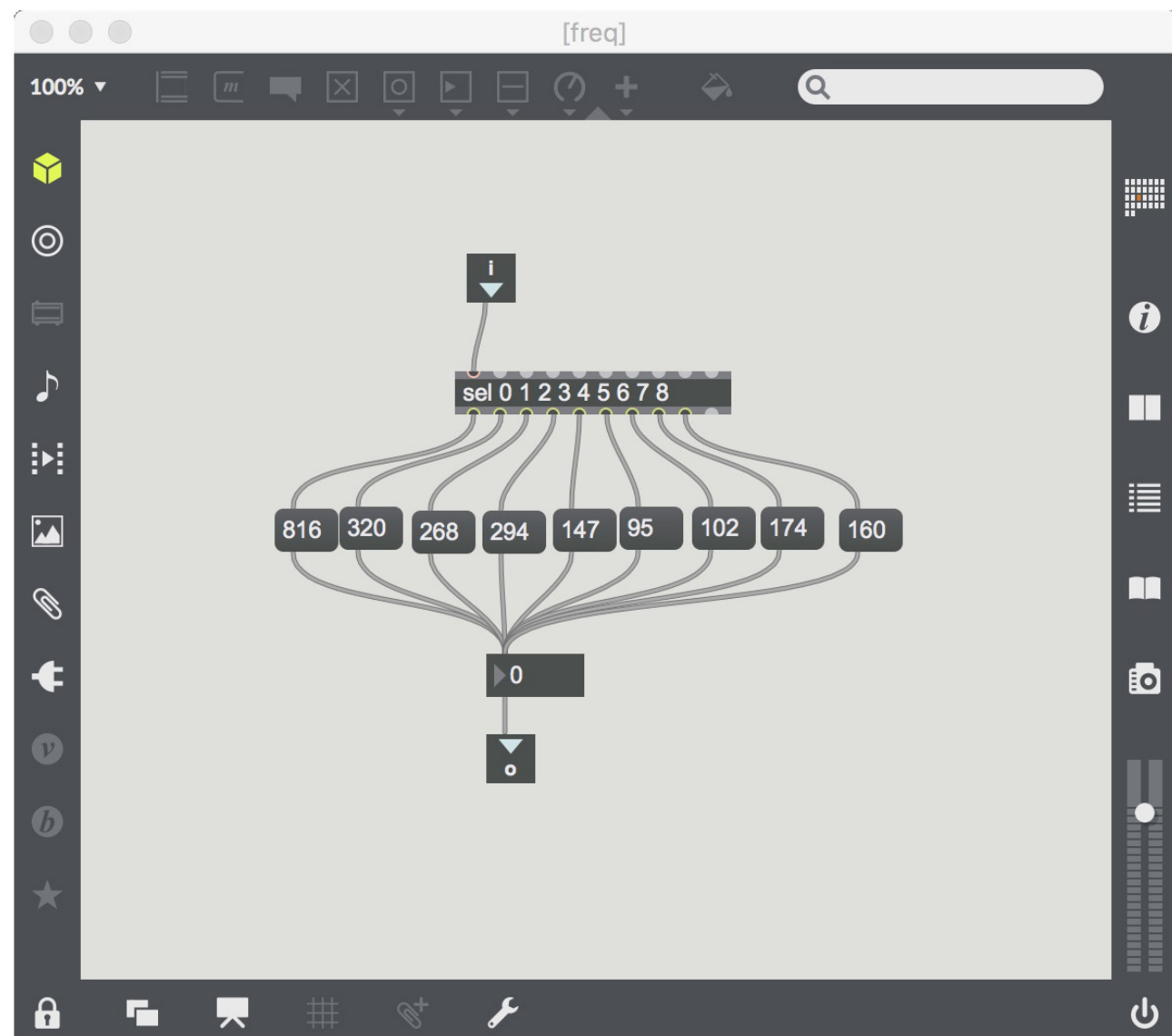
C – The Instrumentation of the Acoustics

According to Local Environmental Data Set-Up

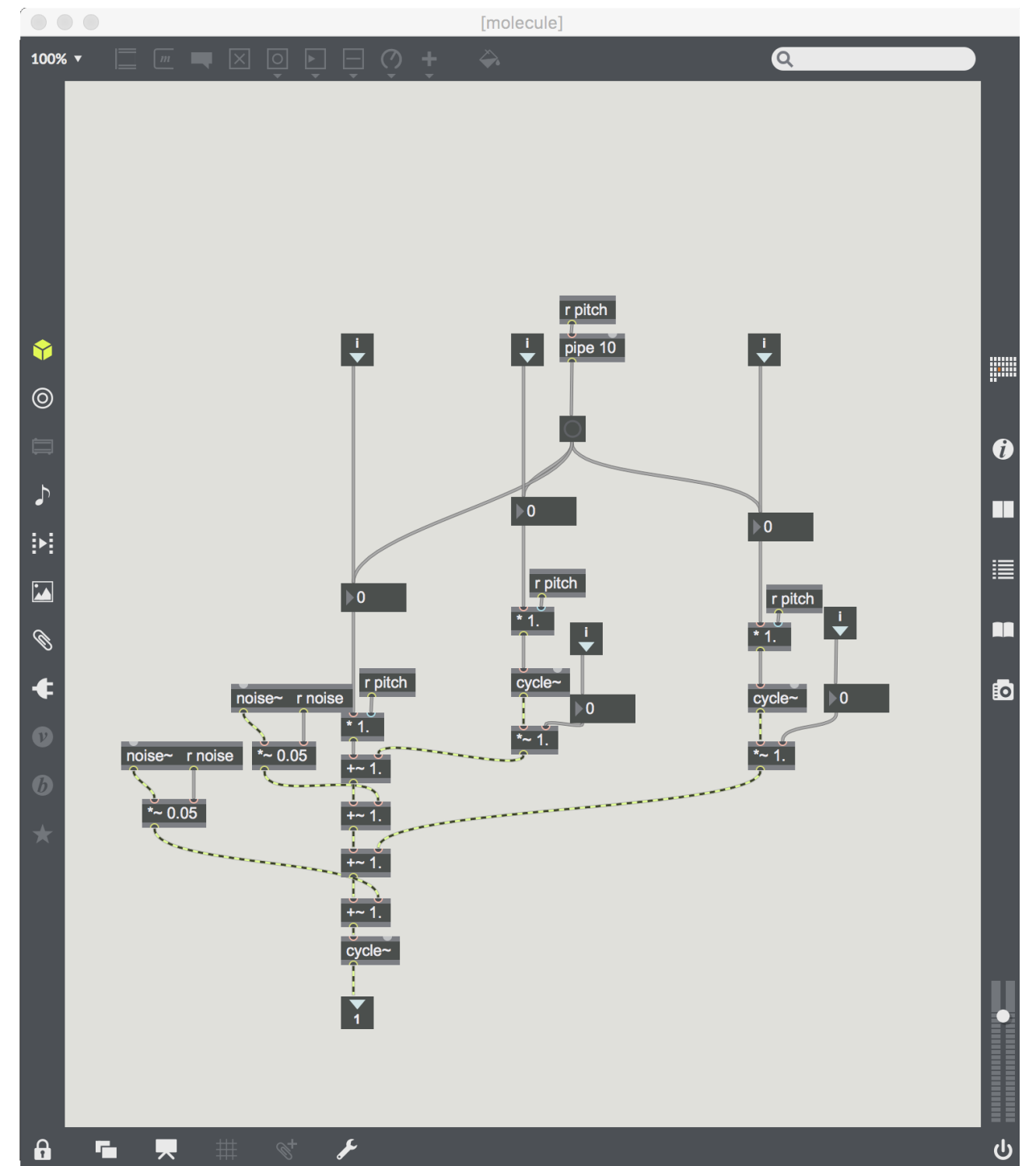
All scientific data regarding one cycle of the tree's metabolism – that is, one day, one season, one year, etc. – are processed in the ways described above, calculating pitches and rhythms by the electronics via Max programming, with one exception: in live performance 'global solar radiation' (GSR) is always played by one acoustic instrument, usually a pitched percussion, such as the marimbaphone.

Max, also known as Max/MSP (audio), and Jitter (video), is a graphic programming environment for music and multimedia. It is widely used by present-day composers, musicians and artists to create their own software.

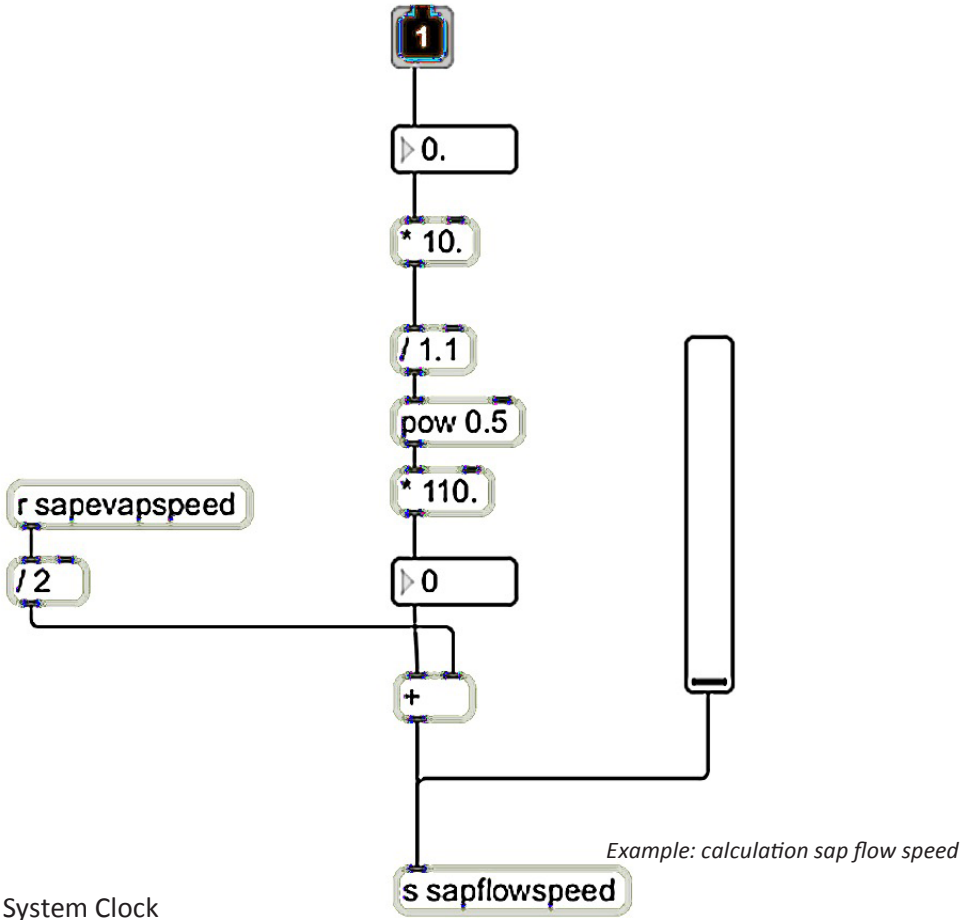
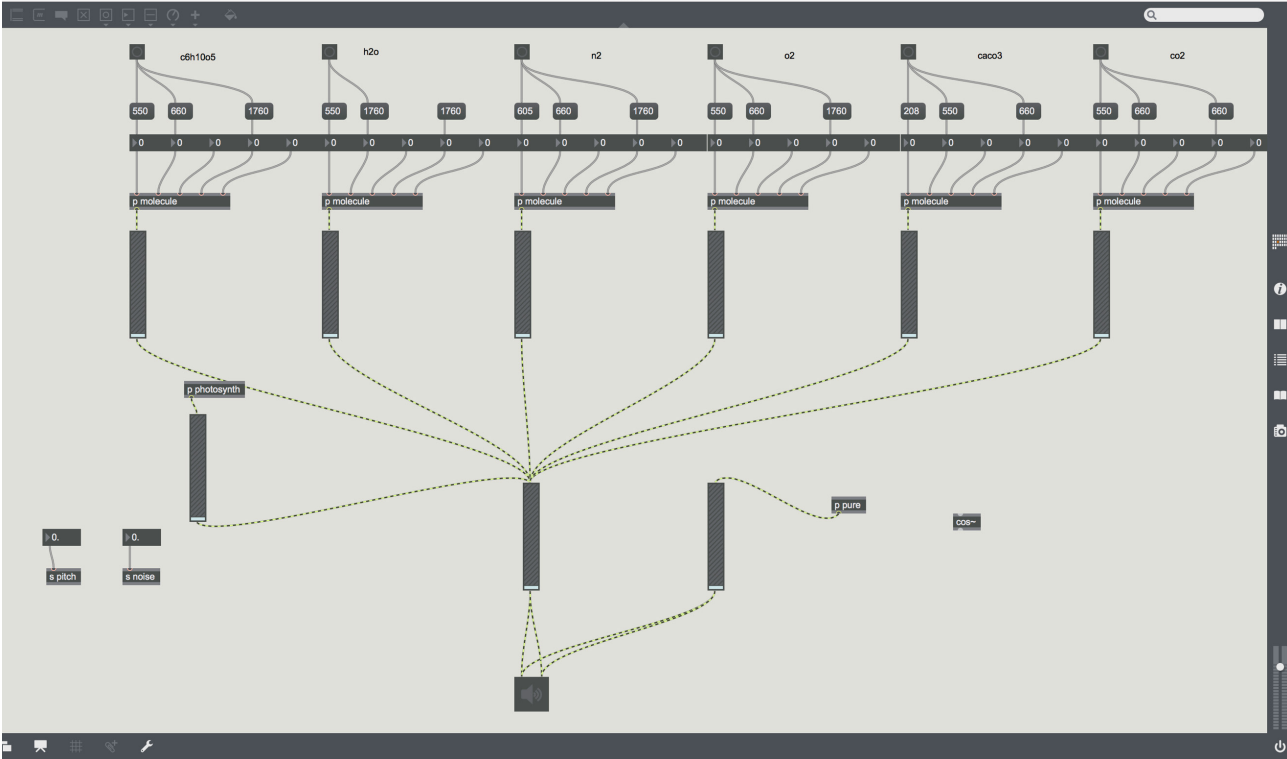
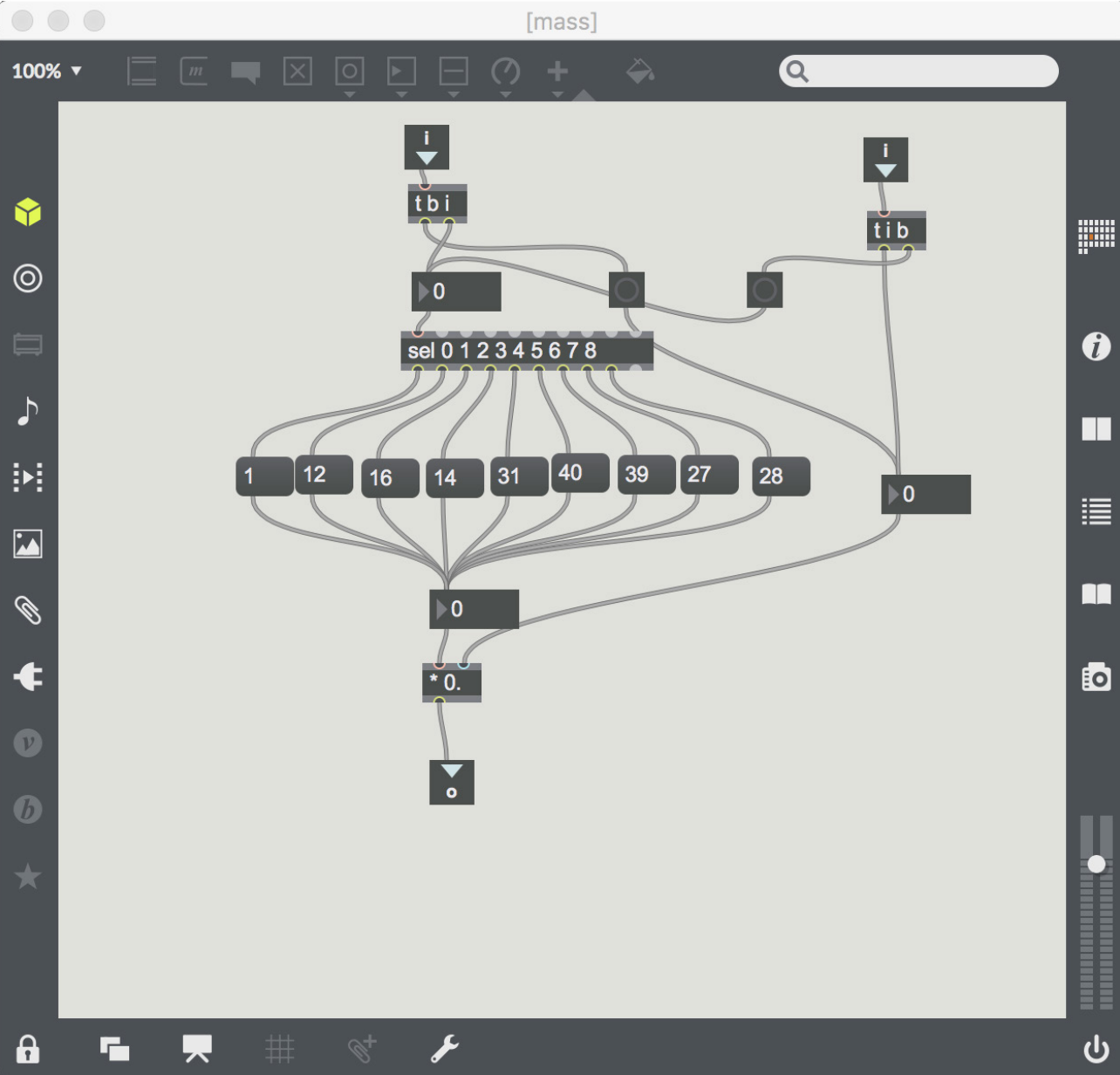
In the following some of *you are variations* example patches
(Programmer: René Thie):



Example: patch for frequency calculation in analogy to molecular structure

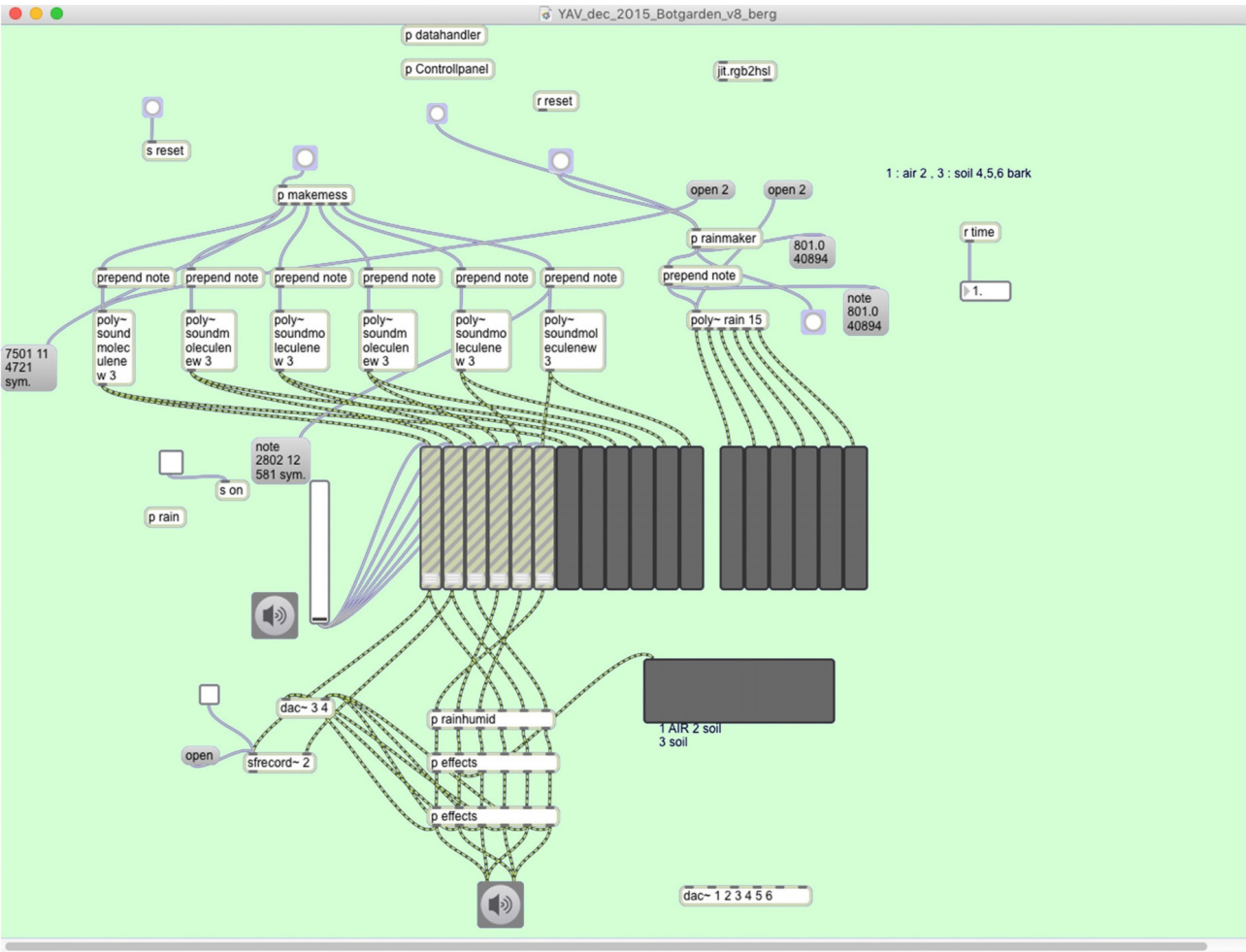


Examples: patch for calculation of overall cycling matter

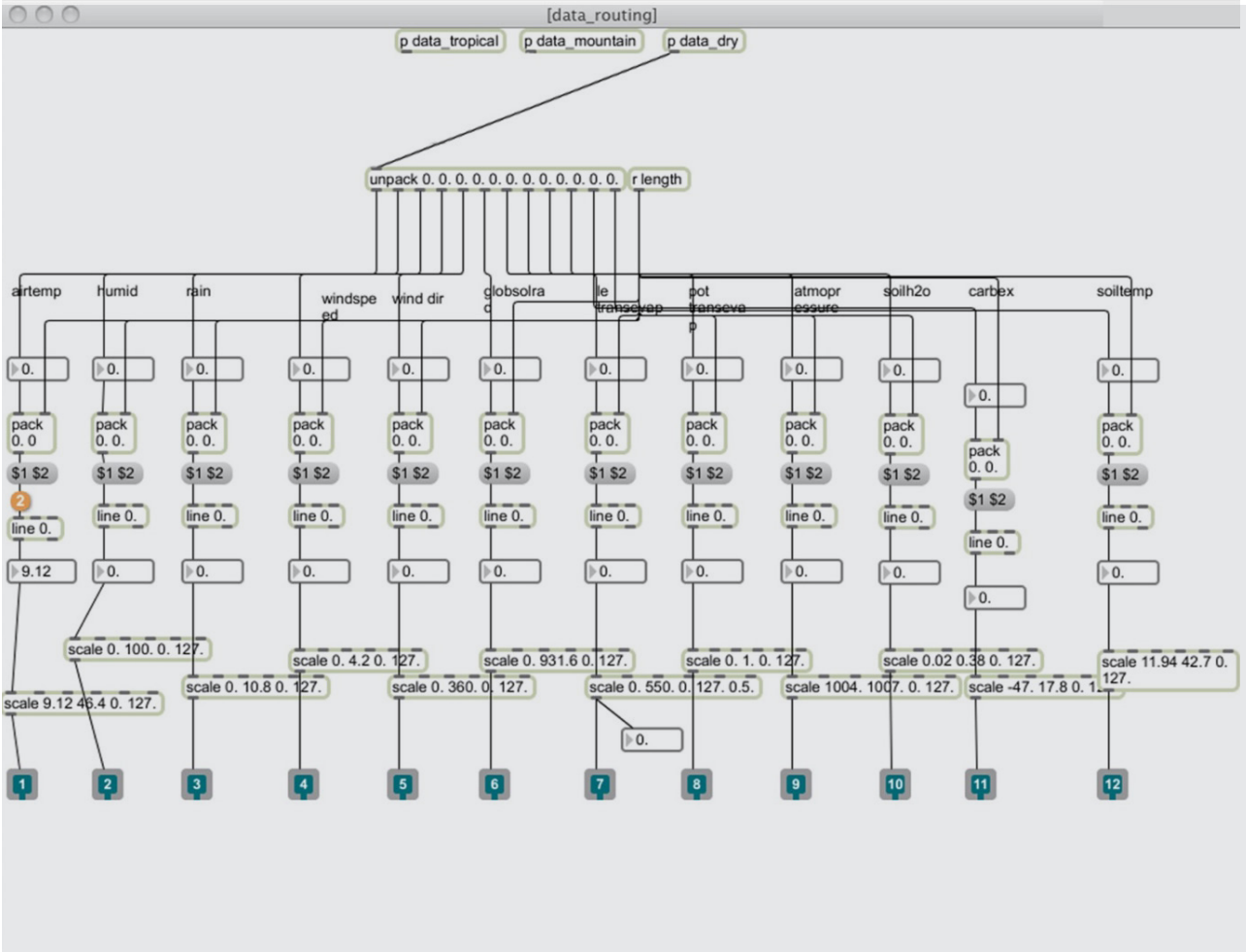


System Clock

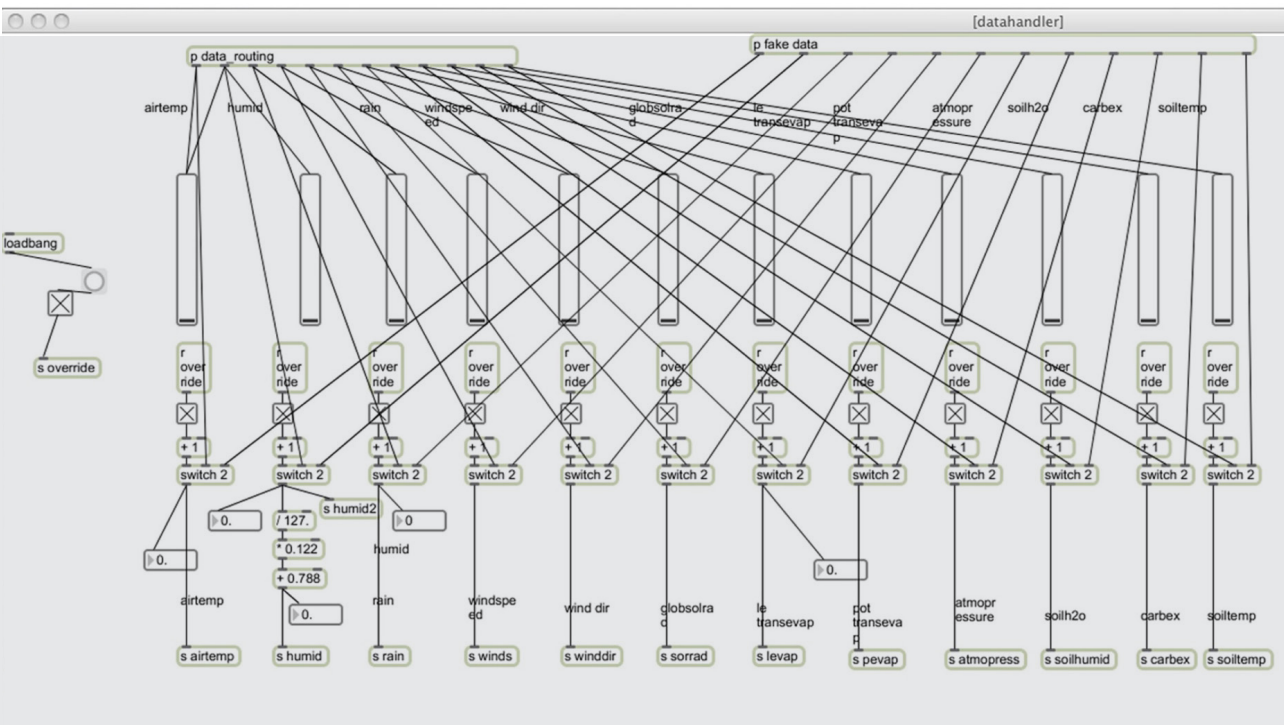
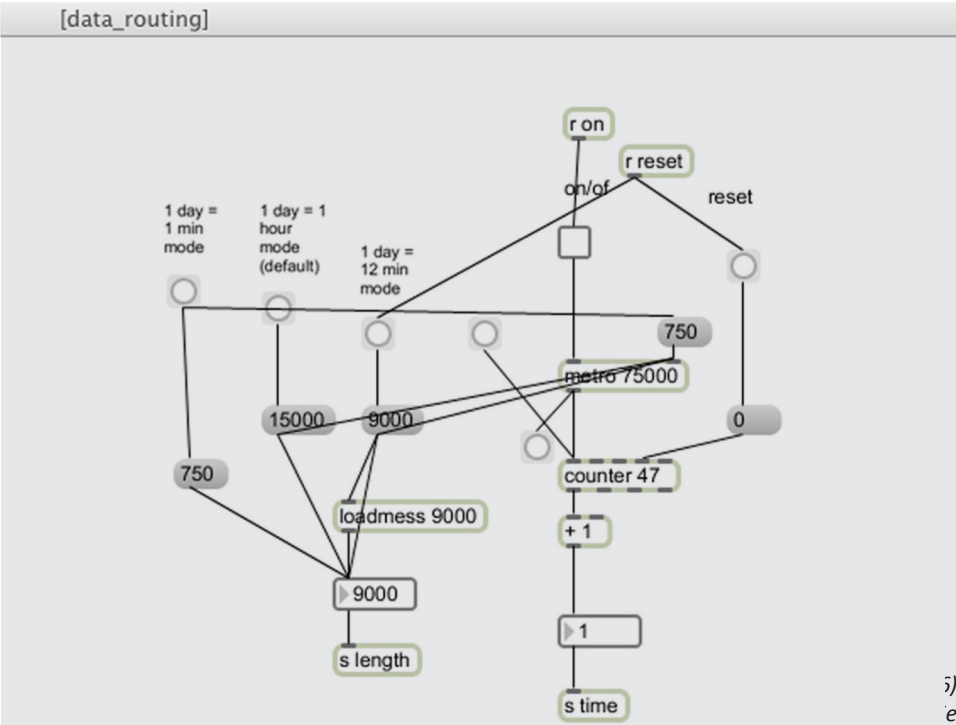
Max patch and processing protocol for electronics



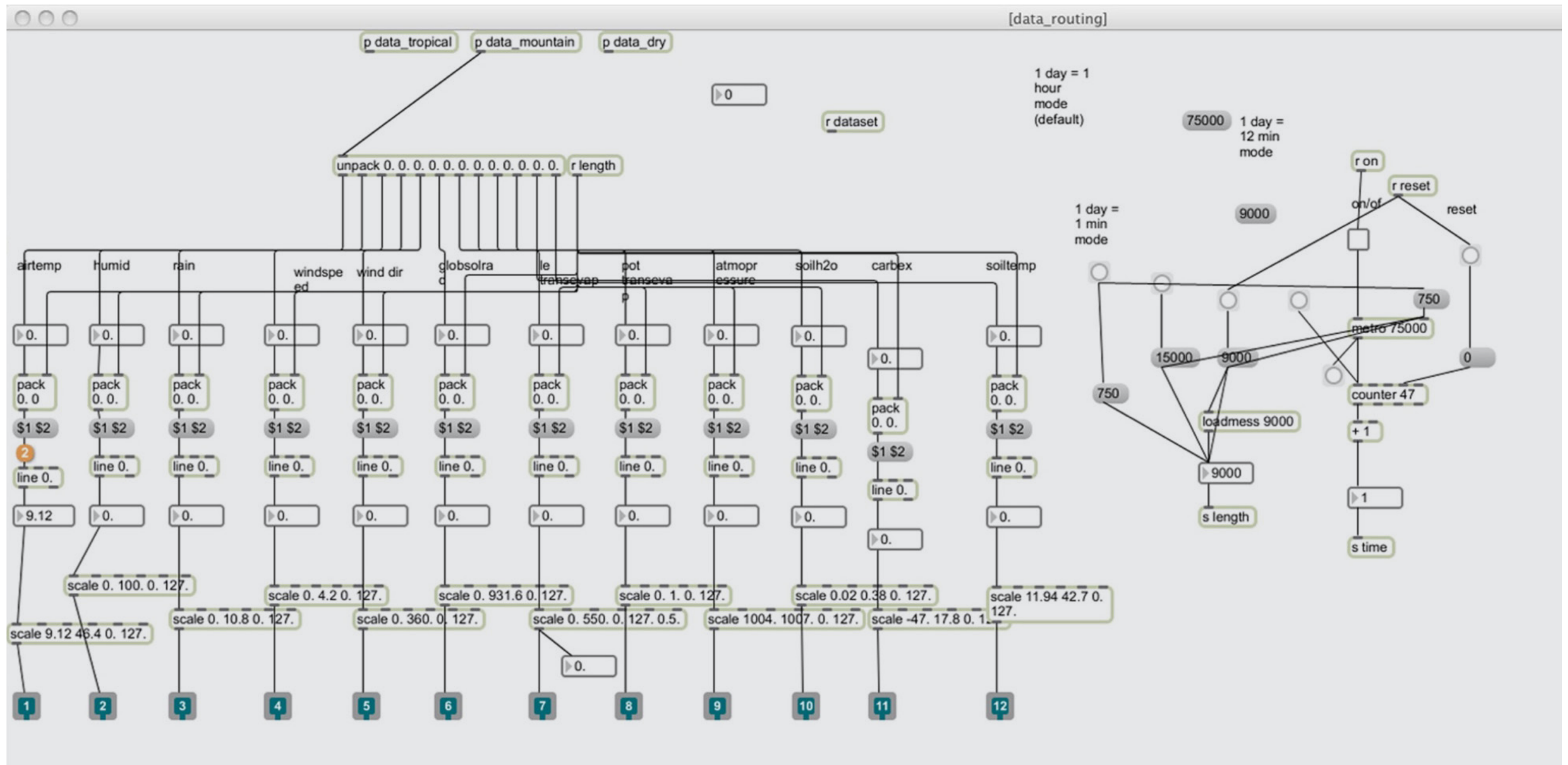
data conversion (text to max; scaling to midi range): tropical dry ecosystem

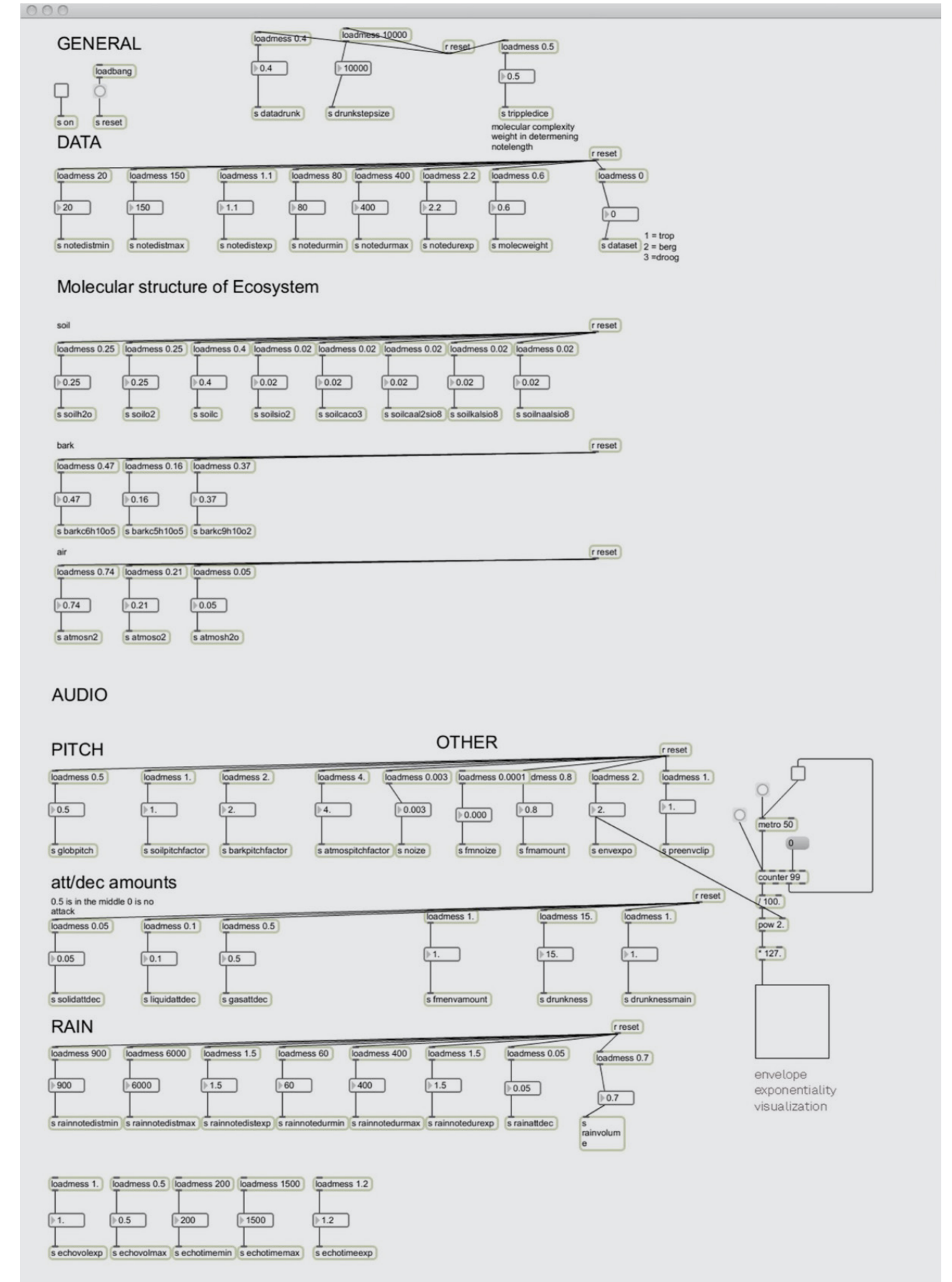
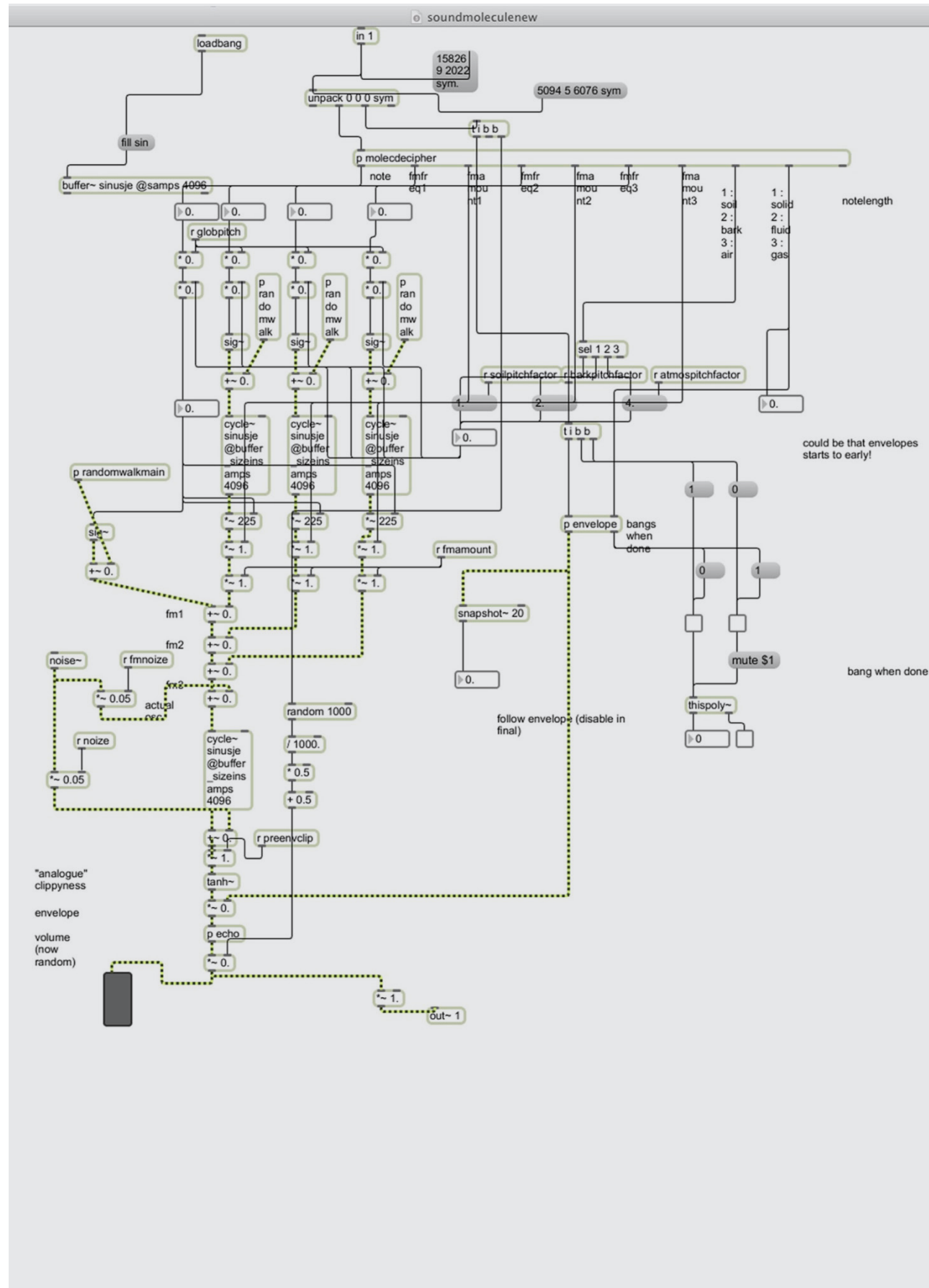


data conversion (text to max)

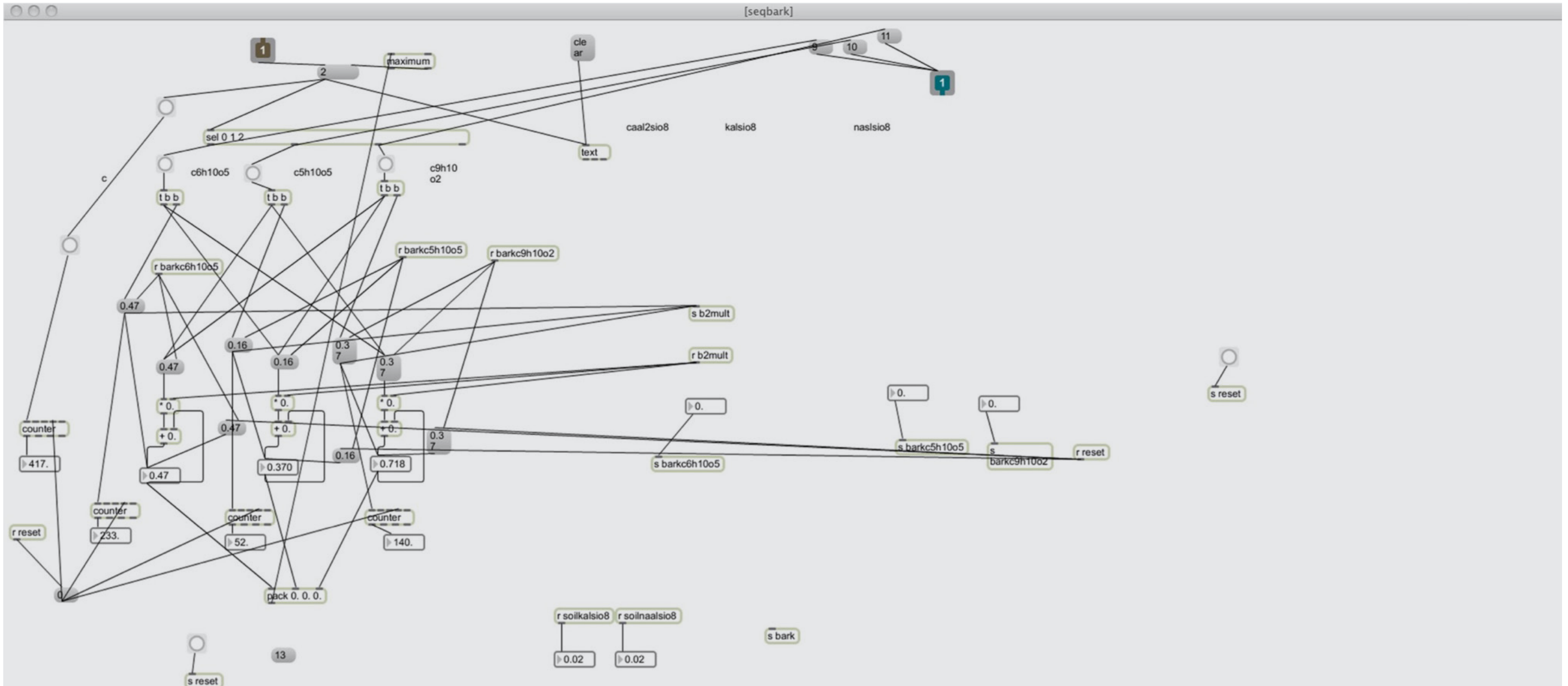


data conversion (text to max; scaling to midi range)





algorithm
for selection of sounds



All molecules in a layer have a base value (according to the amount of their appearance in their sub-ecosystem) and a current value; this algorithm chooses the molecule with the highest current value, sends a note message of that molecule's identity to the synthesizer to play that note, then adds the base value of each molecule, times the highest base value of all molecules in that layer, to the current value of that molecule, and sets the current value of the just chosen molecule to its base value, and repeats.

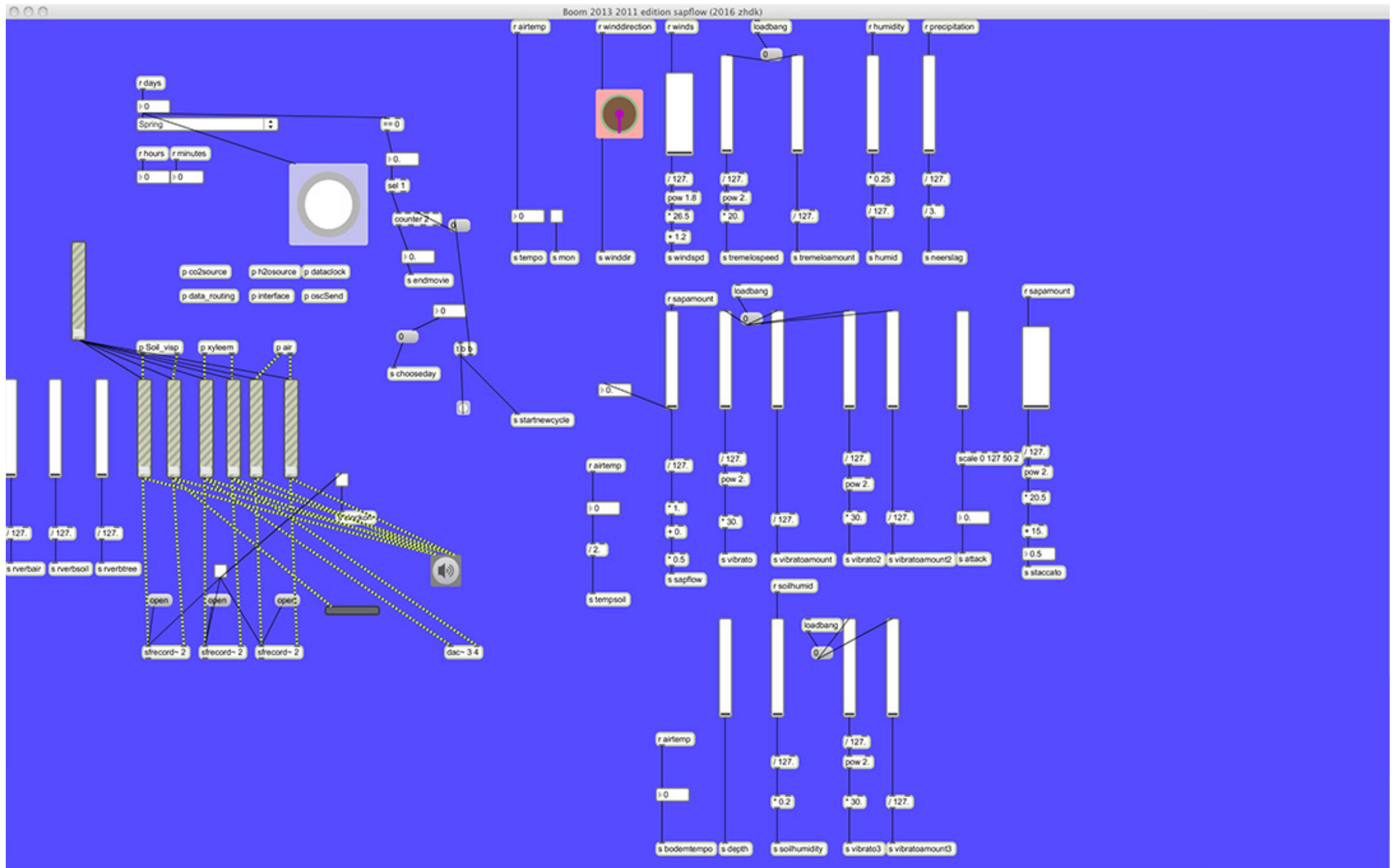
example:

start:
base values $C = 0,47$ $O = 0,16$ $H = 0,37$
highest base value 0,47

round 01:
current values C = 0,47 O = 0,16 H = 0,37
note to synthesizer -> C -> 320 HZ

round 02:
current value $C = 0,47$ $O = 0,16 + 0,16 \times 0,16 = 0,2352$ $H = 0,37 + 0,37 \times 0,47 = 0,5439$
highest value: 0,5439
note to synthesizer $\rightarrow H \rightarrow 816$ HZ

etc.



While the electronics play all data (with the exception of data on Global Solar Radiation in live performance), the dynamic climate data are

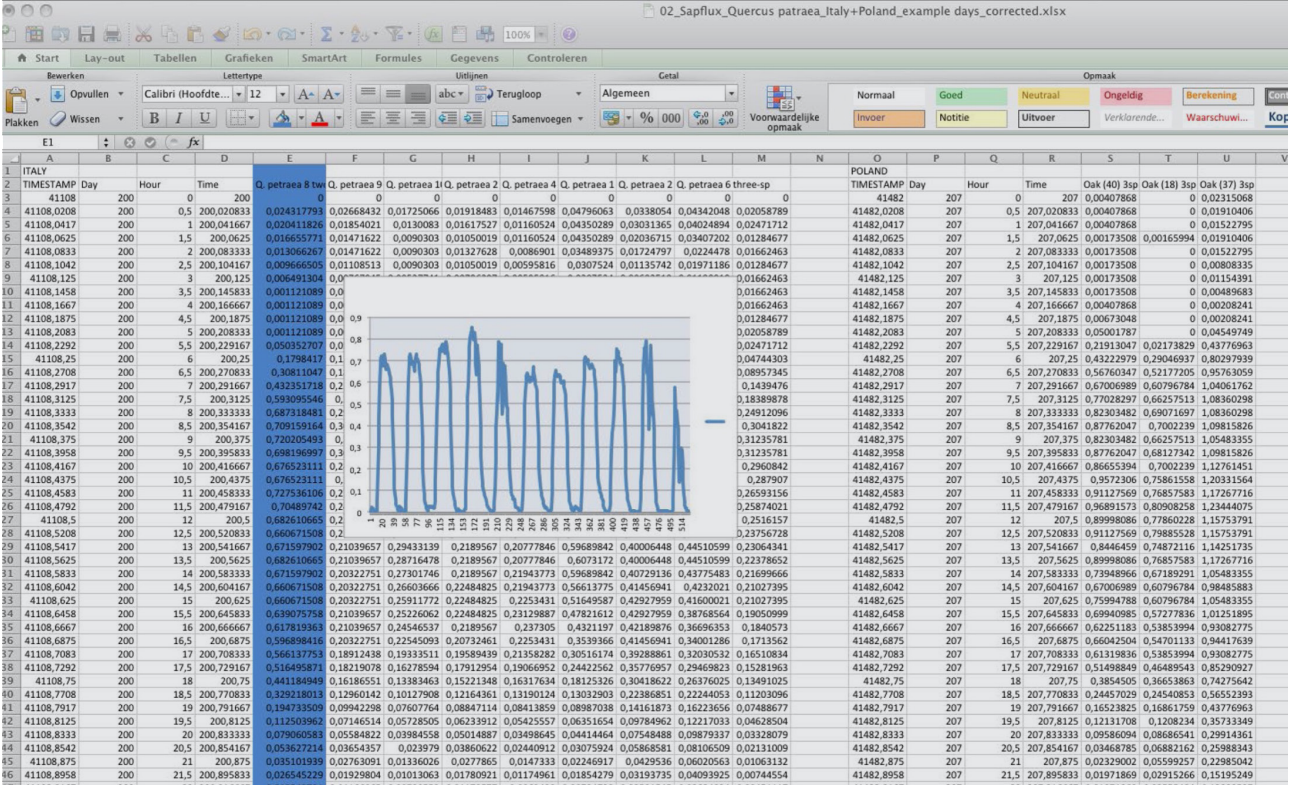
distributed among the acoustic instruments specific to this data following the soil-plant-atmosphere continuum (SPAC) cycle:

- 4 properties of soil/root data are played by pitched percussion
- 3 properties of plant/wood data are played by wind instruments
- 9 properties of atmosphere/meteo data are played by wind instruments

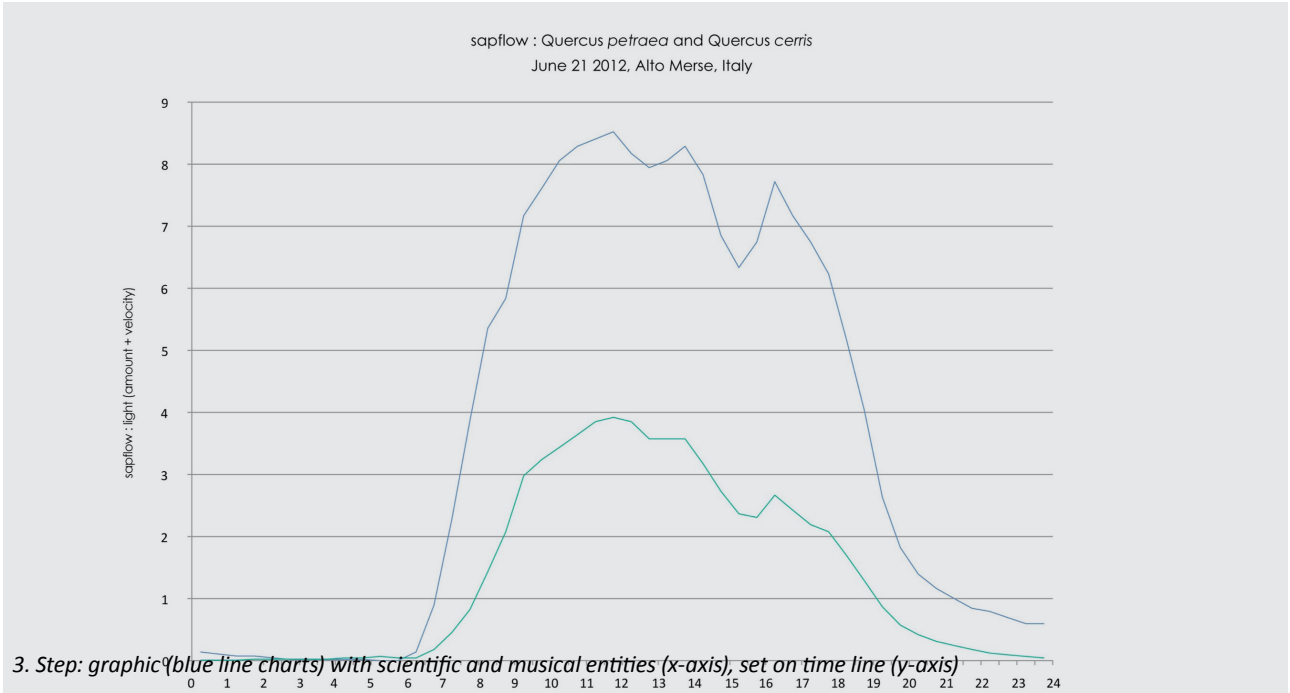
The data are chosen in close collaboration with the scientists involved in the project and extrapolated from scientific data sheets.

In the database they are visibly organized as Excel sheets, in Excel they are turned into a graph, which in turn is exported as a PDF and redesigned as graphic musical notation according to you are *variations*’ design.

The following three tables taken from *version 08* serve as examples of this formatting process:



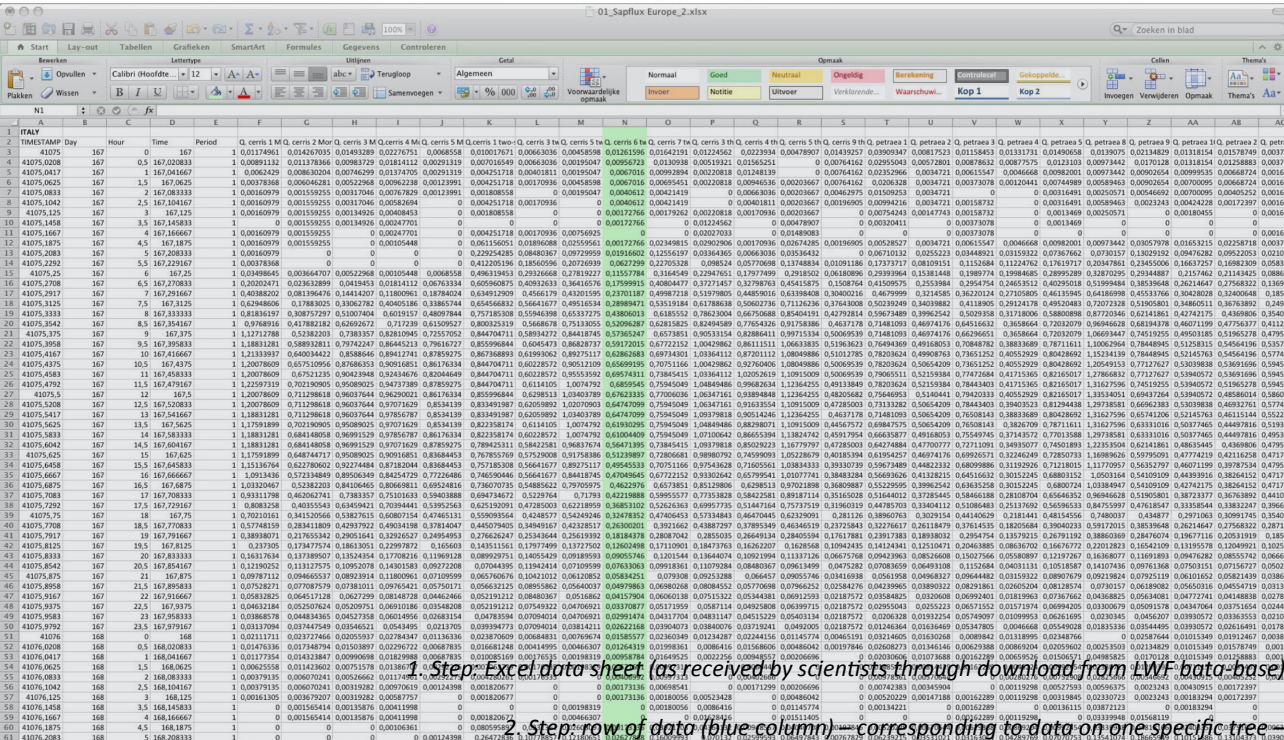
graphic notation for musicians



example: amount of sap flow difference between Quercus petraea and Quercus cerris on 21 June 2012, Alto Merse, Tuscany, Italy by the strings interpreted as range between stretching and fluid

Each step of the you are *variations* methodology is outlined and described in further detail in Appendix 01, where details are provided for the entire trajectory from the scientific data and sources charts, to the actual scores

data sheet from WSL LWF (Excel)



Step: Excel data sheet (as received by scientists through download from LWF data-base)

Step: row of data (blue column) — corresponding to data on one specific tree —

transformed in Excel from data row into graphic (blue line chart)

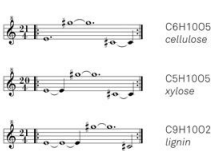
and their use in the performances.⁹⁸

The following tables show examples of notation as shared with musicians and the public, and how it evolved over the course of seven years:

- from stave notation – by approximation of the calculated microtonal pitch to the ‘closest’ known tone in tempered scale on the G-clef – to combinations of stave notation and graphic notation (2011–15)
- the progressive layering of diverse, synchronous time-lines (2015–18)
- experiments with notation as moving graphics on stage (2018)
- experiments with the introduction of ‘unpredictable events’ into the fully scored composition (2016–19)

Scoring Processes


Notational Development in *you are variations* Over the Course of Seven Years
(Example Scores)



C6H10O5
cellulose

C5H10O5
xylose

C9H10O2
lignin



H2O

O2

C


SiO2

CaCO3

CaAl2SiO8

KAlSiO8


NaAlSiO8



O2


H2O

N2



H2O

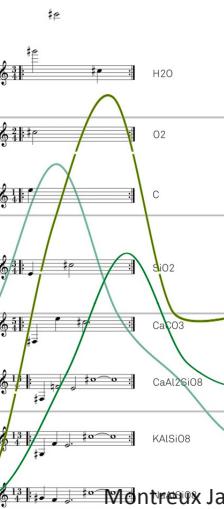
you are variations, version 01,
WSL, Birmensdorf, Switzerland, 18 December 2011
excerpt from the music booklet



C6H10O5
cellulose

C5H10O5
xylose

C9H10O2
lignin



H2O

O2

C

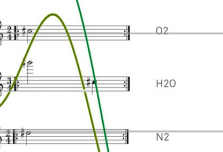
SiO2

CaCO3

CaAl2SiO8

KAlSiO8


NaAlSiO8



O2

H2O

N2



H2O

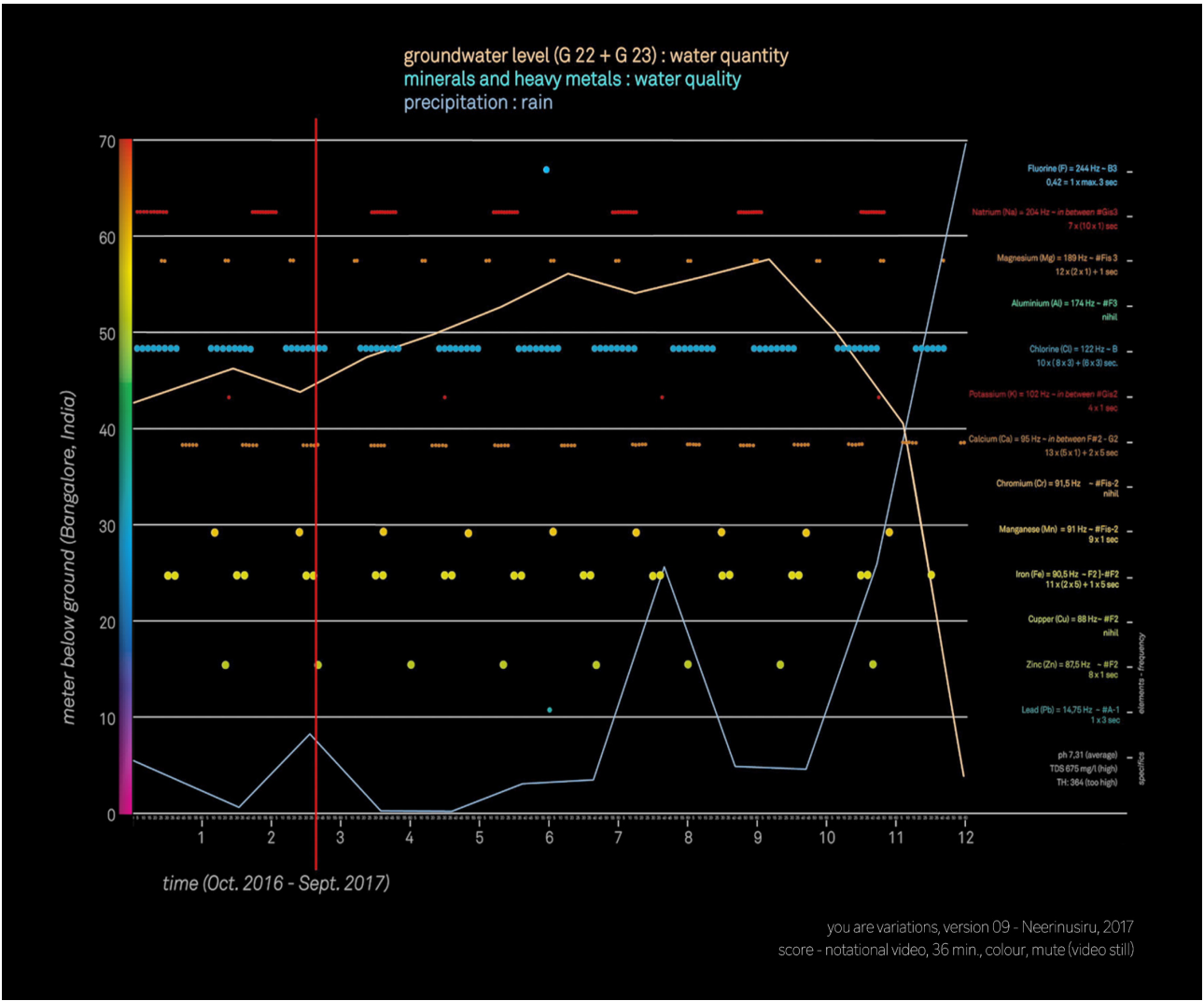
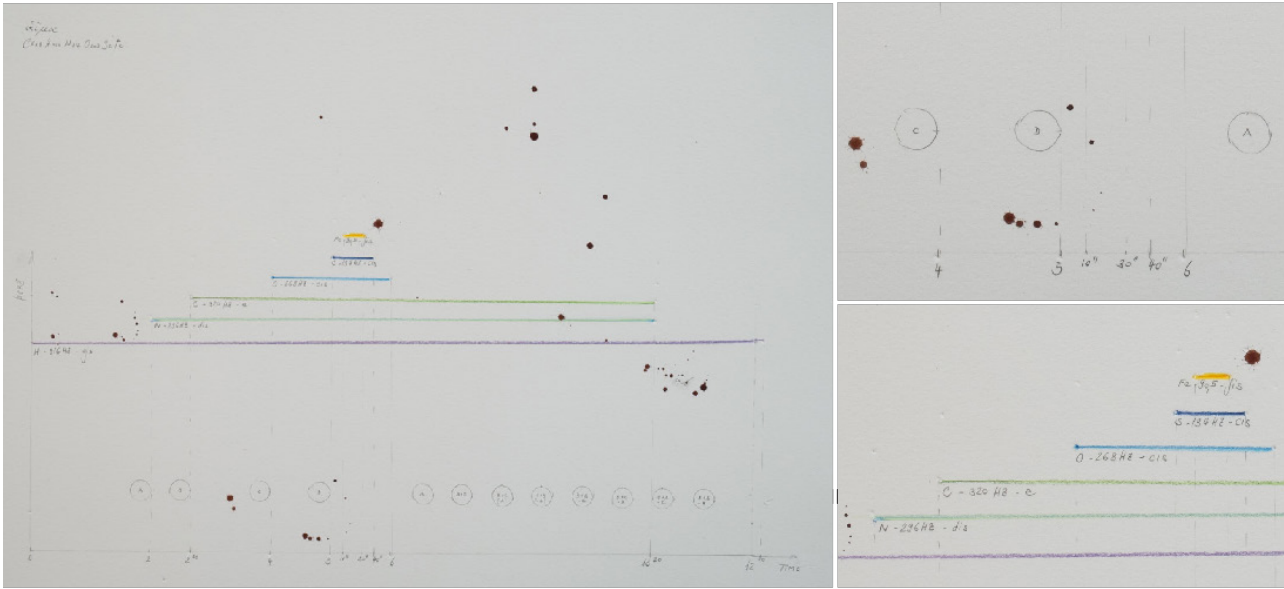
you are variations, version 04,
Montreux Jazz Festival, Switzerland, 18 July 2013
excerpt from the music booklet

sound motif 'tree' [for Cello]

sound motifs 'soil' [for Marimba]

sound motifs 'air' [for Oud]

sound motif 'water' [for Flute]



Method 02 – The Rehearsal

Transdisciplinary Collaboration as Proposition

‘... connect what has been dangerously disconnected ...

The making new of all relationships.’

– Adrienne Rich, ‘Notes Toward a Politics of Location’, 1984

you are variations, version 09 – Neerinusiru
Bangalore, 17 December 2018
xcerpt from the notational video-script

While the diagrammatic scoring described in the previous section
is a process that takes place in consultation with the participating scientists,
it is my inner dialogue with the tree that proposes this specific ‘ecology of
translation’ and its orchestration. In comparison, the process of rehearsing and

practising the score is the process of an expanded collective: while I introduce the tree and the score, the musicians introduce their instruments and propose interpretations of the score according to their intuition and musical experience. It is only now that I hear for the first time how the specific notation of the data in *you are variations* actually sounds. I listen intently to what is de-coded and re-coded conceptually. The initial impulse in *you are variations* is a listening of the mind. The rehearsal is the imminent place where the act of physical listening takes place, not only 'my' listening to 'my' score, but the collective listening to data, possible interpretations and each other. This phase might be compared to the 'modelling' of data according to the research project and its objectives in scientific practice. It is a creative exchange and collaboration that leads to a unique performance. In this stage of the project the association of tree, scientists and myself opens up to the musicians. Again, also in this phase it is crucial to let oneself be guided by the movement incited by the collective process.

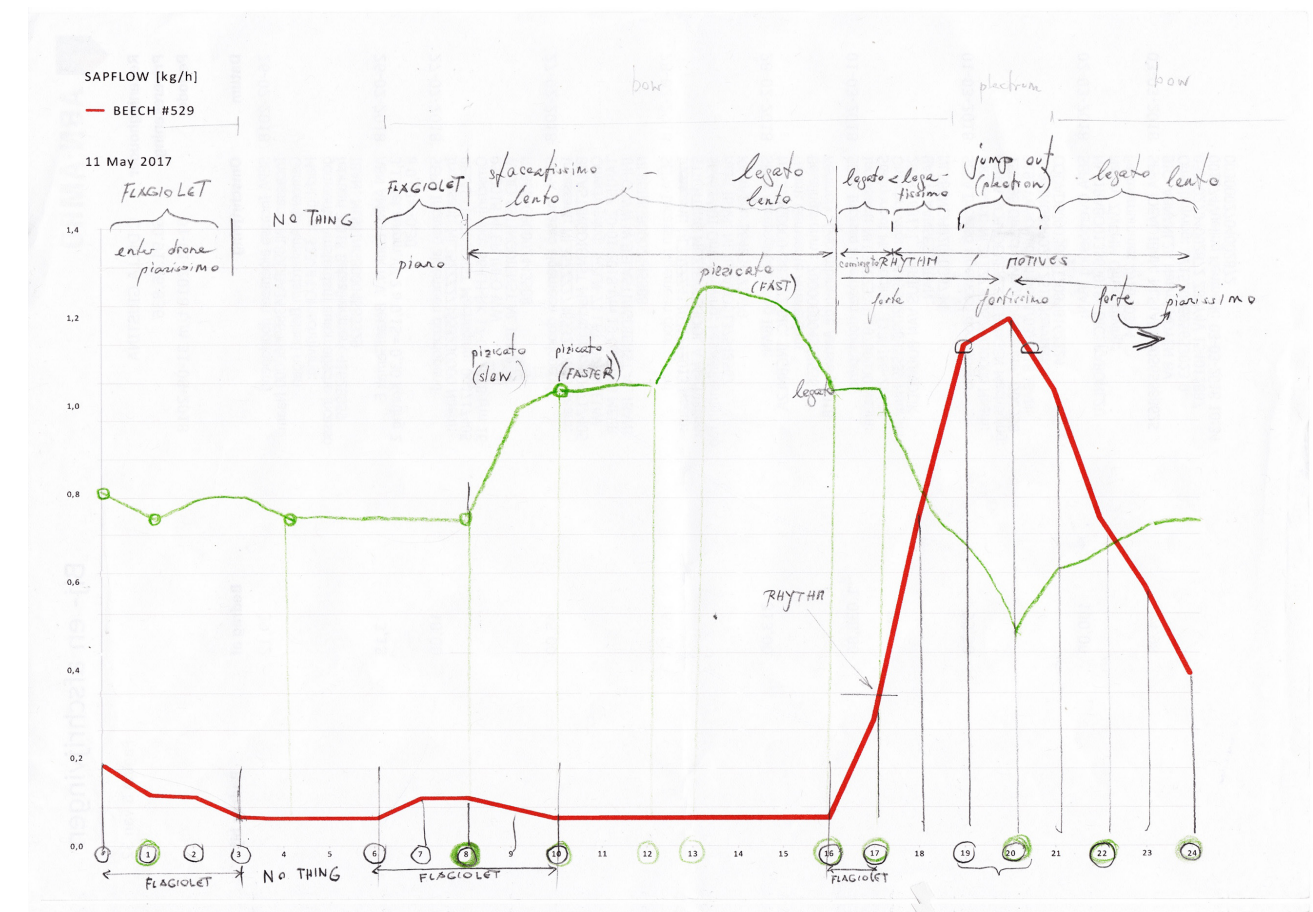
At first the participating musicians are invited to meet the monitored tree. We travel and wander together to the experimental measuring plots, if possible accompanied by the scientists involved. During these excursions we meet in a place of exchange with the tree and each other.⁹⁹ The conversations and experiences during these journeys matter. They allow the musicians to become part of the team and invite them to contribute creatively to the becoming of the piece. *you are variations* cannot be performed by playing from sheet music. The personal inner dialogue between each musician and the tree, as well as amongst each other, is indispensable for a performance of *you are variations* that transcends what we already know. For each tree I translate data sets into scores and assemble them into an electro-acoustic composition, which serves as notation, proposing a sonic process that is performed by acoustic instruments and electronics.¹⁰⁰ Each of the nine versions experiments with graphic notation and develops the *you are variations* notational system further. The notation system has changed over the course of seven years of research.¹⁰¹ While the actual performances do not bring about change to the compositions, they do bring about change to the

⁹⁹ It is noticeable that all the notions circumscribing the *you are variations* methodology as an ecology of translation refer to different notions of 'moving' and 'movement'.

¹⁰¹See former section, pages 99, 100, 101.

How the conceptual score presented in section 01 is used practically during the rehearsal, and how it works during and after practising with the musicians, is exemplified in the following two tables that show the two scores from *you are variations*, version 08, charting 'sapflow' of spruce and beech respectively in use as actual working sheets:

104



105

cosmos inspired by the tree. I am forming (musical) constellations from the charts of the LWF long-term monitoring plots’ ecophysiological measurements and weather data, which themselves interpret the traces the climate has left in trees. They are abstract lines waiting to be interpreted, and have no direct or immanent physical counterpart. It is these abstract lines that are given as gifts to the musicians to play with, and that come back in most unexpected, sonic ways. Equally in performance and rehearsal, an attentive acoustic situation is created. Since *you are variations* plays with a finite set of tones and rhythms, the approach is minimal: tiny shifts, minute differences and gradual changes become perceptible in such a way that a close and detailed listening to each other, as well as to the collective process as a whole, becomes tangible. Perhaps Steve Reich formulated something similar when he stated: I want to be able to hear the process happening throughout the sounding music. ... That area of every gradual (completely controlled) musical process, where one hears the details of the sound moving out away from intentions, occurring for their own acoustic reasons, is it. ... While performing and listening to gradual musical processes one can participate in a particular liberating and impersonal kind of ritual. Focusing in on the musical process makes possible that shift of attention away from he and she and you and me outwards towards it.¹⁰³

Listening closely, everyone’s – also one’s own – perception is entering into the sounds and producing effects that simply could not have been foreseen. Transversal, hybrid and multilateral climatic problems display a complexity and emergence of entanglement that no single disciplinary approach, no mono-perspective methodological tool, and no solitary operation of knowledge production can tackle adequately. What is needed today is a collaborative, post-disciplinary combination of critical forms of (not-)knowing, relating and engaging. Ecology of translation is one such proposition.¹⁰⁴

¹⁰² A further, famous instance is Cage’s 1957 essay ‘Experimental Music’, which urged composers to go about ‘discovering means to let sounds be themselves rather than vehicles for man-made theories or expressions of human sentiments’. See Cage, 1961, p. 10.

¹⁰³ Steve Reich, ‘Music as a Gradual Process’, see http://www.bussigel.com/systemsforplay/wp-content/uploads/2014/02/Reich_Gradual-Process.pdf. There is no concept for improvisation: ‘One can’t improvise in a musical process – the concepts are mutually exclusive.’ Reich, 1968.

Method 03 – The Performance

Sound as Resonance

The ears are not the sole port of entry for music:
it is received through the whole expanse of skin, through the whole body.
When the trance accompanied by music begins,
those who are struck by it often put their hands over their ears
as if they wanted to stop up the orifice through which syncope is entering.
But it is not to close it; it is in order better to take in the flux of vibrations, to savor the hearing.
In India singers keep one hand on their ears to accompany their internal inspiration;
the other placed on the lap beats time with the palm turned up.
From time to time the hand leaves the ear and moves towards another invisible hand:
towards you, or towards it, one never knows.
– Catherine Clément, *Syncope*, 1994

¹⁰⁴ A detailed list of participating scientists and musicians and their creative roles in the collaboration can be found in Appendix 01.

The resulting performance is the recreation of the tree as a sonorous event. In this third step the research opens up to a specific performance time and space, and its audience. Similar to the establishing of vital, creative connections during the scoring process and during the rehearsals, the performance initiates and leads everyone involved through a process of relating. Conceptually and topologically, the location where the performance takes place is relevant and always related to the tree, respectively the ecosystem, where the measurements took place and the data were gathered. The performance spaces are always chosen in proximity to the measured tree. The performance, together with the location, serves as medium to bring the data back to their origin, the tree. In this way, the performance is not only the last step in the *you are variations* cycle – from score through rehearsal to performance – but also concludes the cycle of the data’s trajectory – from the tree to the scientific research centre to the art studio back to tree. It is the cycle from local to general to local. To close the cycle by playing ‘as close as possible to the tree’ is important. Accordingly, we choose the

performance space carefully: its proximity to the tree, as well as properties regarding its acoustics, size, location, histories, etc. matter. It is all these situated and site-specific parameters together that co-shape the experience of work.

In a first settling in, we usually clean the performance space together. It is important to comprehend that everything in the space – including the space itself – interacts and resonates. By cleaning the space we not only eliminate clutter from past events, but also touch it. The space where we play is the trees' resonance chamber. It eminently partakes in the performance. Especially in the later performances the walls confining the space feel like the bark, the outer shell of the tree: a significant border necessary to create a centre with a hollow, a cavity that gradually becomes the inside of the tree, as well as oneself. This centre has to be empty. The space contains only the musicians, the instruments and the audience. All are arranged in concentric circles around an empty space in the middle. I insist that nothing is placed in the central empty space – no music stand, no cable coiling, no recording device – even if it might be an ideal place for documentation purposes. The empty space in the middle is conceived for the imagination, the unexpected. The musicians are placed around it in a circle. Chairs are placed carefully in consecutive circular shells one by one for the participating audience.

you are variations, version 08-01
 Colloredo Mansfield Palace, Prague; 18 October 2018
empty centre photographed from above (Photograph: Zuzana Pištěková)

The low-volume electronic sound fills the space before the audience enters and remains as they leave; so too are the musicians and their instruments present as the audience enters and leaves. There is no announcement made and no talking. There are one or two projections of a clock signal at the beginning and end of the piece.

The static sound cloud before the beginning of the performance is the sum total of the trees' frequency field before the cycle presented; the static sound cloud that stays after the end of the performance is the sum total of the trees' frequency after the cycle.

Since the data *you are variations* works with come from climate research, all versions consist of comparisons between ecosystems with regard to a cycle: one day, one season, one year, etc. For the performance the time of the cycle is condensed into a performance time that is feasible with respect to the concentration span of the musicians and the attention span of the audience, and at the same time point to and acknowledge long, unusual durations:



information before the performance and after the performance. Some members of the audience appreciate knowing exactly what they are listening to beforehand. Others prefer a plain listening experience, with the option to receive relevant information afterwards. Since in our opinion all possible information regarding the context of our mutual research is of utmost importance, my science partners and I started to offer both: a facultative introduction into the scientific and artistic research about an hour before we play, and a Q&A about an hour after the event. It is because I wish to provide as much insight as possible that I make sure the performances themselves take place purely sonically.

It is in *you are variations* performances that I learn to listen; in a first instance not to 'what' the voice of the tree says, but also to voice as such: the voice of the performance space, the voice from within the cello, the voice within us, that serves as ulterior linkage between the human, the non-human and the divine¹⁰⁵:

¹⁰⁵ ‘Link’ is etymologically kin to ‘yoke’, the bow, bar or frame of wood by which two water buckets of water are carried on the shoulders, or two draught animals are joined at their necks enabling the pull a plough or cart, etc. It shares the same root with Hindi ‘yoga’, from Sanskrit yoga-s, literally ‘union, yoking’, from PIE root *yeug– ‘to join’. The hyphen can be interpreted similarly: derived from Ancient Greek ὑφ’ ἑν (hyph’ hén), contracted from ὑπό ἑν (hypó hén), ‘in one’ (literally ‘under one’). The word (ἡ) ὑφέν [(he) hyphén] was used for an undertie-like sign written below two consecutive letters to indicate that they belong to the same word when it was necessary to avoid ambiguity, before the space ‘character’ was in regular use. See <http://www.perseus.tufts.edu/hopper/text?doc=Perseus:text:1999.04.0057:entry=u%28fe%2Fn>

Spruce (*Picea abies*) at Načetín research plot (Photograph: David Petráš)



When Orpheus sings, it is in order to tame wild beasts and persuade gods. His true audience consists not of men, but of creatures beneath and above natures and cultures. In chant, with notational devices such as the rosary,¹⁰⁶ speaking and singing are one, singing each place (branch) and its associated totems. The score serves to prompt the memory, to record (*ricordare*, in the sense of re-binding, remember) the connection: sound. When we connect to it we call it music. In performance *you are variations* collectively remembers the connection to the tree. When we connect to it we become / *wi*/.¹⁰⁷

¹⁰⁶ The holy rosary (Latin: *rosarium*, ‘crown or garland of roses’), refers to a chain or string of knots or beads used in the Catholic Church to manually count a set of prayers as an aid towards praying in the proper rhythm and sequence.

¹⁰⁷ The list of all trees, scientific measuring plots, scores and performances can be found in Appendix 01, Table of Events.



dwells there. In its daily self-renewal it grows along roots and branches through the soil and the air. The tree moves. I wish the *you are variations* methodology to move similarly, researching *becoming* rather than *being*. The artistic process is an engagement in a critical trajectory that involves multiplicities on all levels. The application of methods of translation emerge as the work proceeds: at various times they run, follow and guide the process, then go along with the process towards a new version. The project's methodology is one of moving, of journeying along.¹⁰⁸ Art's methods are unlike those of the sciences. They are as unverifiable, unprovable, unrepeatable as life itself; rather, they are pilgrims of becoming. *you are variations* designates the unrepeatable. It actually cannot be assimilated to an initial phase, which then, a posteriori, gets identified and replaced by an approach conforming to an explicit set of methods forming an intrinsic methodology.

Paul Klee too offers a methodological rationale to refrain from a static conception of merely recording reality: 'The artist of today is more than an improved camera; he is more complex, richer, and more spatial. [...]



His growth in the vision and contemplation of nature enables him to rise towards a metaphysical view of the world and to form free abstract structures which surpass schematic intention and achieve a new naturalness,

the naturalness of the work ... ¹⁰⁹ This ‘new naturalness’ is a precious methodological line that meshes with Whitehead’s critique on the modern bifurcation of nature into science and intuition.¹¹⁰

Art making does not happen by following a prescriptive design. Art making works precisely the other way round.¹¹¹ Similarly, the path of the tree cannot be predicted by any science whatsoever: an element of not-knowing is unavoidable. Perhaps in creative processes, as well as in natural processes, the initial entropy actually increases.¹¹²

Accordingly, as an artist I do not aspire to ‘discover’, but to ‘create’, and what I do along the way is not a ‘discovery’, but a ‘creation’. Artistic practice is the experience of being utterly involved and intensely participatory in the artworks’ becoming – for we have never been autonomous – but very much together with our material.

I wish neither to sharpen, nor to insist on the divide between scientific discovery and artistic creation. Instead and together with Whitehead, this report hopes to turn into an invitation to remember and/or extend the concept of creativity and creation by and to the sciences too.

¹⁰⁸ Or, as Deleuze in *The Fold*, 1993 puts it: ‘for Whitehead ... even God desists from being a Being who compares worlds and chooses the richest compossible. He becomes Process, a process that at once affirms impossibles and passes through them.’ p. 81.

¹⁰⁹ Klee, 1961 [1923], pp. 63–67.

Case Studies

¹¹⁰ Thanks to Chiara Ambrosio for this valuable link.

01: *you are variations, version 01 - 02 - wiir sii d’Böüm*

¹¹¹ While it has to be added that error as such does not guarantee art making either.

Sosta in Leuk, the Montreux Jazz Festival and Ferme d’Asile, Sion, all in CH 2015

¹¹² Not following pre-described guidelines, also means to learn to wait. In the process, the senses have their very own timing, in my experience often forcing me to slow down, pause, halt. In my diary, I write: ‘Waiting until it is silent around you seems to become easier, soon I shall hear you; I learn to be slow, receptive – I shall look into this slowness, trace it, exercise it; there is a soft carpet on which we can learn to fly.’ My diary, 24 April 2015.

... It must be one of the motives of a complete cosmology

to construct a system of ideas which brings

the aesthetic, ethical, and religious interests into relation

with those world concepts which have their origin in natural science.

– Alfred North Whitehead, *Process and Reality*, 1929

you are variations, version 01_02/03 from 2015 consists of the interpretation of data from a series of *Pinus sylvestris*, unevenly aged between 40 and 170 years old, growing at 1033–93 metres altitude above Leuk, close to the nature reserve Pfyn-Finges in the Valais canton in the Swiss Alps.

from Leuk at the local cultural centre Sosta on 1 May 2015, at the nearby Montreux Jazz Festival on 18 July 2015 and at the art centre Ferme d’Asile in Sion, Valais on 30 October 2015. A copy of the score can be found in Appendix 01. The scientific data from the experimental LWF plots around Leuk – performed site-specifically and site-responsively together with members of the local community living close to the tree – are returned to the place from which they originated.¹¹³ At the end of my residency at the Swiss Federal Institute for Forest, Snow and Landscape Research WSL, the aforementioned scientists Prof Dr Andreas Rigling (forest ecologist, head of the research unit Forest Dynamics, member of the directorate of the Swiss Federal Institute for Forest, Snow and Landscape Research, and adjunct professor at ETH Zurich), Prof Fritz Schweingruber, Dr Marcus Schaub and Dr Matthias Dobbertin† of the think tank we had built during my stay asked me about my future plans, specifically, ‘what do you envision to do with the data?’ It was clear to me that I would continue with the project, conceiving a unique score for each of the 19 trees measured in Switzerland and the 168 trees in the rest of Europe. It seemed self-evident

firstly to formulate a concept for all 19 Swiss data sets, followed by the 168 European plots, to give as much room as possible for site-specific choices for each single composition.

While looking at the maps with the experimental LWF long-term monitoring and International Co-operative Programme on the Assessment and Monitoring of Air Pollution Effects on Forests (ICP) plots, I imagined a particular score for each tree, crafted according to the location's characteristics, histories and costumes. A rich pallet of environmental, cultural and social differences and specificities came to mind, such as the deliberate focus and restriction on musical instruments rooted in the histories of the eco-social, that is, the environmental and cultural community in the region, in combination with electronics.¹¹⁴ The mix of musical legacies on site, local players and a performative setting in the vicinity of the measured trees, became a key feature to work with.

In letting myself be led by the tree's data and site, the differences between the two sources of information became apparent to me. The data formed a record of past events. Can it (and with it the past) be animated into the present by (solely) contextualising and situating it? I started to play with the thought of bringing the archive to its source; to carry the data in an altered state back to where it was gathered, to give it back to the tree; an understanding of the work as an act of making amends, a mode of repair, revealing itself in the trajectory from 'data' (verb/gerundivum in the past tense of 'dare', literally 'given') to dare (verb/gerundium in the present tense, literally 'giving'). In working with 'data', *you are variations* turns 'the given' into 'giving'.¹¹⁵

I formulated the thought of (re-)turning the given (data) into forms of giving (dare) in the summer of 2011. In collaboration with Irène Hediger, Viviane Leupin-Aggeler and Joel Sames from the Institute for Cultural Studies in the Arts, Zurich University of the Arts (ZHdK), it took almost four years of preparation to realise the collaborative performance of one data set from a tree in the Valais noted above. Dr Rigling and I, along with fellow scientists Prof Dr Arthur Gessler (Director of the Long-term Forest Ecosystem Research (LWF), Group Leader Forest Growth, and Climate Adjunct Professor ETH Zurich), soil science specialist Marco Walser, dendro-ecologist Daniel Nievergelt together with the musicians Dieter Buchwalder (glass harp and stone-, bamboo- and

¹¹³ Documentary of the performance at Ferme d'Asile, Sion, Valais, Switzerland on 30 October 2015, 5 min, <https://vimeo.com/165268814>; the working process is compiled into a 15-minute documentary, <https://vimeo.com/user25007893/yav-01-02-documentary>; drawing made by the children, <https://vimeo.com/user25007893/youarevariation-s0102childrendrawings2015>.

knotweed-percussion), Francis Petter (saxophone, clarinet, bass clarinet and bottles), Désirée Senn (cello and voice), René Thie (marimba, sticks and electronics) went to meet the other performers. We encountered a bunch of lively, curious and dedicated eight- to ten-year-olds and two slightly cautious teachers. Everybody agreed to work together and half a year later four scientists, four musicians, twenty-five children, two teachers and an artist spent ten intensive days together studying the tree.

We visited the tree on day one, with the following days dedicated to root, stem and leaf. The children got to know about soil science technologies, drumming techniques, dendrochronological measuring methods, rhythmic exercises, experiments on gas exchange, breathing and drawing techniques and spent three hours each day learning the score and practising its tune. The enthusiasm, energy and joy of everybody involved was unprecedented. Everyone questioned, everyone learnt, everyone played. The encounter pushed boundaries. It created an experience of intense elation.

During the workshop one of the children, Rayen, particularly shy and who suffered from mutism, started to speak for the first time during a rehearsal and continues to this day. He participated in the workshop fully, and in all of the final performances at Sosta, the Montreux Jazz Festival and Ferme d’Asile.

¹¹⁴ I only then fully realised how the entire development and histories of musical instruments, together with their specificities, limits and possibilities, is a direct result of the materiality and flux of the ecosystem, from which they derive and through which they perform.

¹¹⁵ Re-cord, binding again (Italian: *recordare* = remembering).

02: *you are variations*, version 09 - Neerinusiru
Bangalore, IN, 17 December 2018

... And I say symphony rather than cacophony
because we have had to learn to orchestrate those furies
so that they do not tear us apart.
– Audre Lorde, *Sister Outsider*, 1984

The historical chapter as part of the appendices assigns itself to the study of different tuning systems and the knowledge forms inherent to them, treating ‘systems of order’ and the ‘perceptions of sound’ as intricately intertwined Western cultural traditions.¹¹⁶ Inherent musical practices such as ‘tuning’, ‘listening’ and ‘relating’, are markers in the cultural creation of meaning. *you are variations* conceptualises and applies them as follows:

- – listening as tuning
- the ethical/ecological respect, linking the study to signal legacies of political ecology
- *listening in the sense of ‘to attune’, as in ‘tuning oneself’, to the world (listen)*
- – tuning as listening
- the aesthetic/artistic prospect, feeding the generic, creative aspects:
- *inventing a (new) musical scale (tune)*
- – mutual relationality
- the cosmopolitical and spiritual aspects
- *listening and tuning oneself in the sense of channelling the energies, working towards a natural-cultural un-divide by mediating between human and more-than-human worlds*

The three interrelated aims pursue an overall sensitising and extending of scope, playing with temporalities and scales, such as slowing down, amplifying, phasing, etc., as main methods of addressing ecological issues by means of extending our sensing capacities.

A consequence in the application of these working methods, especially with regard to their interrelatedness, can be found in the research on the branching trajectory of water not only within natures (that is, trees), but also within cultures (such as a river's course through a city): as an example, *you are variations, version 09*, works with data from urban environments, specifically with data on the water quality in its trajectory through the city of Bengaluru, India.

The working mode is again 'circular', as well as 'branching', reinvesting the entry point, as well as the exit, in a gesture that attempts to correlate and commune between natural and cultural environments.^{117 118}

you are variations, version 09 – Neerinusiru was performed in the frame of *BeFantastic* at the Rangasthala, Rangoli Metro Art Center, Bengaluru on 17 ember 2017.¹¹⁹ It is composed with the data from the Bangalore Urban tabolism Project (BUMP),¹²⁰ in close collaboration with Vishal Mehta – rologist and environmental modeller at Stockholm Environment Institute US), a non-profit research organisation on energy, water and climate policy offices in San Diego where Vishal is based, as well as in Massachusetts and shington – courtesy of the Indian Institute of Science (IISc) and SEI US.

¹¹⁶ See Appendix 01, 'Historical Framework'

The musicians involved are Vasundhara Das (voice), an Indian er, actress, composer and environmentalist;¹²¹ Saitejas Chandrashekar la, darbouka, ghatam and harmonica), a Classical Carnatic musician;¹²² Liu Ting Chun (programming), an artist from Taipei, working at the ders of sensibility and perception.¹²³ The piece brings together critical ntific research, creative practice and experimental technology to articulate galore's water usage in a publicly engaging manner. It involves the iposition of a musical score based on water research data gathered in t collaboration between IISc and SEI,¹²⁴ and ongoing research guided by US

scientists working under Senior Scientist Dr Vishal Mehta. Acclaimed singer and musician Vasundhara Das and Sai Chandrashekar, classical Carnatic and Hindustani instrumentalists, play the score with electronics programmed by Liu Ting Chun and performed by Christina Della Giustina, making each note a testament to each single person’s water usage, informing a city-wide ecological challenge encapsulated in the intricate Indian conditions of contemporary water consumption. *you are variations, version 09 – Neerinusiru*, consists of the interpretation of data from 10 years of scientific research on diverse aspects regarding the quality of water flowing through Bengaluru, one of the most rapidly growing urban centres and the fastest growing urban agglomerations in India.

you are variations envisions Bangalore as a living organism,

depending on internal and external metabolic flows to remain alive. Among the diverse metabolic urban flows of matter and energy, water is vital – especially water used for drinking and cleansing humans and other kin. *you are variations* proposes a metabolic acoustic framework for the water quality in three districts of Bangalore: a spot on the grid in the old centre, an open field in the old rural west of the city and a climate hotspot in the south, the Silicon Valley of electronic mass-production.

The project on the water qualities in Bangalore – a growing conglomeration understood as a tightly-associated social, cultural and ecological organism – showed that a spatially specific and explicit understanding of consumption patterns is crucial in addressing three central aspects of Bangalore’s water conundrum: ecological sustainability, equity and economic efficiency: not only does water as a resource flow into the city, but also waste flows out after the resources have been consumed.

The entire circle – from incoming and return flows (flow of unused and used water to the underground aquifers) and leakage flows brought into the city (from imported river water) – needs to be considered when trying to understand the entire process of depletion of groundwater. Bengaluru’s increasing water demand leads to an increasing dependence on groundwater extraction. Groundwater levels were measured at 150 locations at a monthly frequency in 2016 and a distributed groundwater model was developed to understand the socio-hydrology of Bengaluru’s groundwater.¹²⁵ The measured

groundwater level data were used to estimate the ensemble of behavioural

parameters of the model.¹²⁶ Most urban grids showed a negative water balance, except for a few grids lying at the very centre of Bangalore.

The following diagrams show the main findings of the BUMP research project:

variations, version 09 – Neerinusiru, was publicly rehearsed at the Chisenhale Dance Space, London on 1 December 2017 in the frame of *Work Processing – A Forum for the Sharing of Live Practice*, <https://workprocessing.wordpress.com/>. In this rehearsal the *work processing* participants at Chisenhale were ‘the voice’, Liu Ting Chun did the programming and Van der Maaden made the video documentation, <https://workprocessing.wordpress.com/2017/11/17/wp17>. Photographs and a video excerpt can be found in Appendix 01. Bangalore’s tech-art festival, BeFantastic aims to present digital interactive arts to harken a radical, open, optimistic future for the city. The Rangoli Metro Art Center located in the central hub of Mahatma Gandhi Road, houses installations, performances, workshops, screenings, talks and discussions to create a public imagination of tech-art and its untapped potential. The triennale envisions a positive, sustainable future leveraging creativity in open city spaces. Its founding team comprise architects, designers, artists and technologists connecting their practice with participatory processes and government bodies: <https://befantastic.in/bf-17/>.

¹²⁰ See <http://bangalore.urbanmetabolism.asia>.

¹²¹ A recent project by her is *Shah Hussain* (2013), a joint album with Sufi singer Mir Mukhtiyar Ali.

¹²² Sai’s sister, Sumana Chandrashekar, is one of a few women in India to play and investigate the ghatam, exploring notions of gender embodied in the sounds of the ghatam, an Indian percussion instrument prohibited for women and predominantly played by men. Sumana Chandrashekar is a Carnatic vocalist and ghatam player. She learnt to play the ghatam under the tutelage of Sukkanya Ramgopal, the first woman to play the instrument on stage. This gendering of space finds its roots in both the anti-nautch and nationalist movements. As a result, women would either learn to play a mellifluous instrument like the veena or the violin, or would be trained as vocalists, while percussion, almost exclusively, became a male domain.

¹²³ Liu Ting Chun works with algorithms,

Slides used to introduce *Bangalore Urban Metabolism Project (BUMP)* <https://www.sei.org/projects-and-tools/projects/bump/>

¹¹⁷ ‘A slow epistemology of perplexity’ as Stengers proposes in ‘The Cosmopolitical Proposal’, in Latour and Wiebel (ed.), 2005, pp. 994–1003.

¹¹⁸ Theoretical physicist David Bohm is one example of someone who was influenced by Whitehead’s philosophy of organisms. Other scientists include, physical chemist Ilya Prigogine, philosophers Isabelle Stengers and Donna J. Haraway, biologist Conrad Hal Waddington, geneticists Charles Birch and Sewall Wright, a.o

¹¹⁹ *you are variations, version 09 – Neerinusiru*, documentation of performance, BeFantastic, Rangasthala, Rangoli Metro Art Center, Bengaluru, India, 17 December 2017, 2 min 37 sec, <https://vimeo.com/263476433>, see Appendix 01 for photographs and video excerpt. Acknowledgements: groundwater level data collection: P. Giriraj, Sanjeeva Murthy and Dr Muddu Sekhar (IISc); groundwater quality data: Department of Mines and Geology; rainfall data: Karnataka State Drought Monitoring Cell; web interface: Douglas Wang (SEI); principal investigator: Dr Vishal Mehta (SEI); research funding: Cities Alliance Catalytic Fund; video editing: Milo van der Maaden, Netherlands; special thanks to: Swissnex, Pro Helvetia and Irène Hediger, artists-in-labs, ZHdK Zurich; and Van der Maaden and the *work processing* team. *you are*

sound, visuals, body and net art in an experimental discourse on the relationship between real and virtual worlds.

¹²⁴ Indian Institute of Science and Stockholm Environment Institute.

¹²⁵ Mehta and his team S. K. Tomer, M. Sekhar, Krishnachandran Balakrishnan and Deepak Malghan. Preprint submitted to *Science of the Total Environment* on 31 October 2017. A model-based estimate of the groundwater budget and associated uncertainties in Bengaluru, India, December 2020. Mehta et al., 2021.

¹²⁶ Using Generalized Likelihood Uncertainty Estimate (GLUE) methodology. Using ensemble of behavioural parameters, the uncertainties in various components of urban groundwater budget (i.e., recharge from rainfall and leakage in water supply and sewerage system, base-flow, draft, demand) were estimated and discussed. Total

The BUMP data from SEI were performed site-specifically and site-responsively together with a Hindustani and a Carnatic musician on site – restoring the data to the place from which they originated. I was invited by

VISHAL K MEHTA, RIMI GOSWAMI, ERIC KEMP-BENEDICT, SEKHAR MUDDU, DEEPAK MALGHAN

The rapid growth of urban India has added new saliency to the resource conflict between the burgeoning cities and village India that continues to be the home for vast majority of Indians. Cities, like living organisms, depend on external metabolic flows to keep them alive. Among all the metabolic flows of matter and energy none is more important than water – especially water used for meeting basic drinking water and other domestic consumption needs.

As India continues to rapidly urbanise, it is vital to understand cities’ crucial dependence on social and natural resources of rural areas, and on its own natural resources (Wimberley and Morris 2006). Cities are like living organisms, depending on external metabolic flows of matter and energy to keep them alive and for growth, generating waste in the process (Decker et al 2000; Newman 1999). In a deeply unequal society like India, the political economy of this “social metabolism” is characterised by conflicts across caste, class, economic and geographic-demographic axes – urban versus rural, the rich versus the poor, agriculture versus industry, adivasis versus the rest, upper castes versus the subaltern castes, slum-dwellers versus the rest of the city, men versus women, etc.¹

Potability of Groundwater

The quality of drinking water is mainly referred to pH, Total Hardness as CaCO₃, Total Dissolved Solids, NO₃, Fe and F apart from heavy metals and possible bacteriological contaminations. The water suitability for drinking purposes is categorized based on the specifications of WHO and IS standards - 2003.

Artificial Groundwater Recharge

The demand for water is mainly due to population pressure and higher scale of social and economic activity. Groundwater level is declining drastically in the last three decades resulting in drying up of open wells and shallow bore wells. The only remedial measure to overcome the problem of over exploitation is to conserve rain water and to have a judicious approach while using the water resources.

Among all the metabolic flows of matter and energy none is more important and more contested than water – especially water used for meeting basic drinking and other domestic consumption needs. India is home to a significant proportion of an estimated 1.5-2 billion people around the world without access to clean sources of drinking water. Only 35% of households in rural areas and 71% of households in urban areas have access to drinking water within their household premises.²

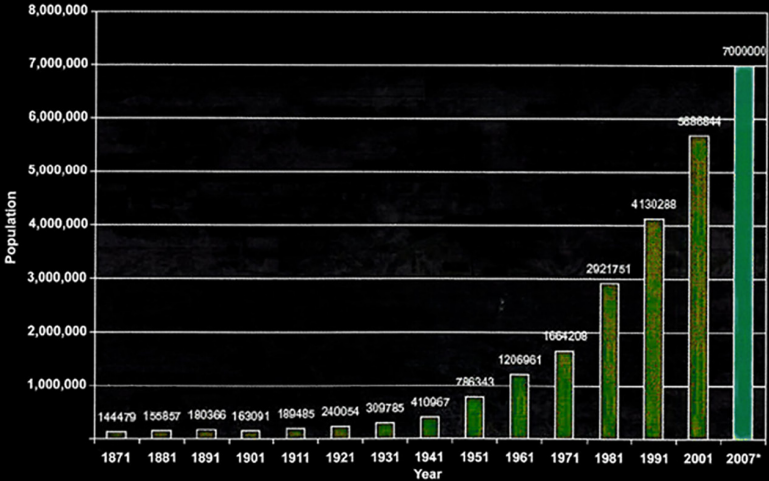


Figure 9 : Population growth of Bangalore city (Source: Census of India 2001) (78 Lakhs for 2010 Projected)

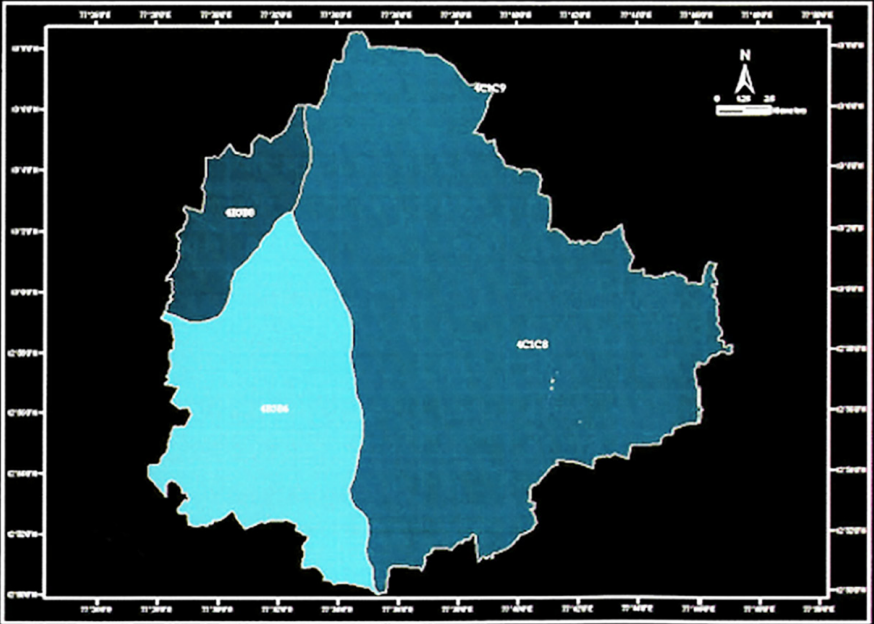
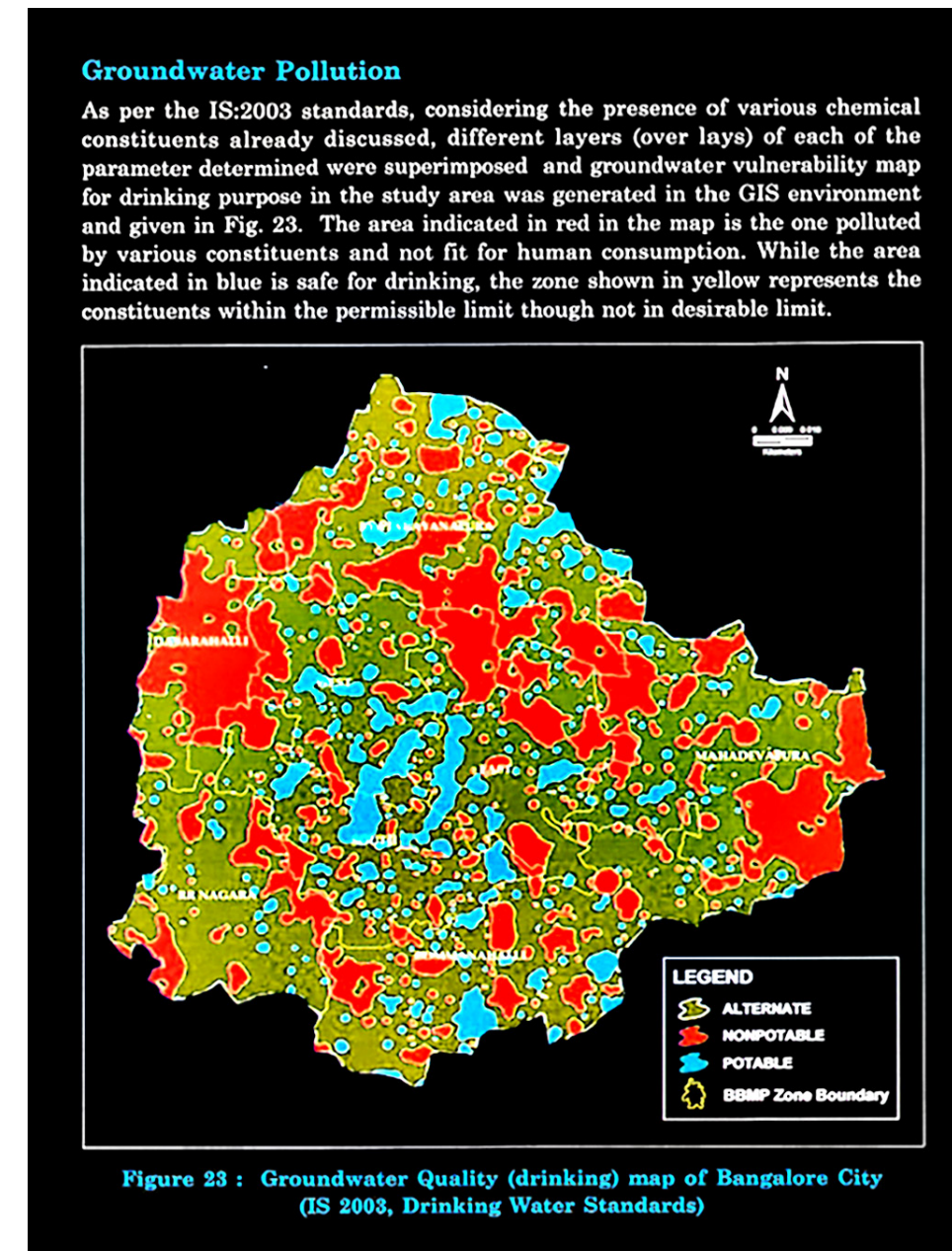
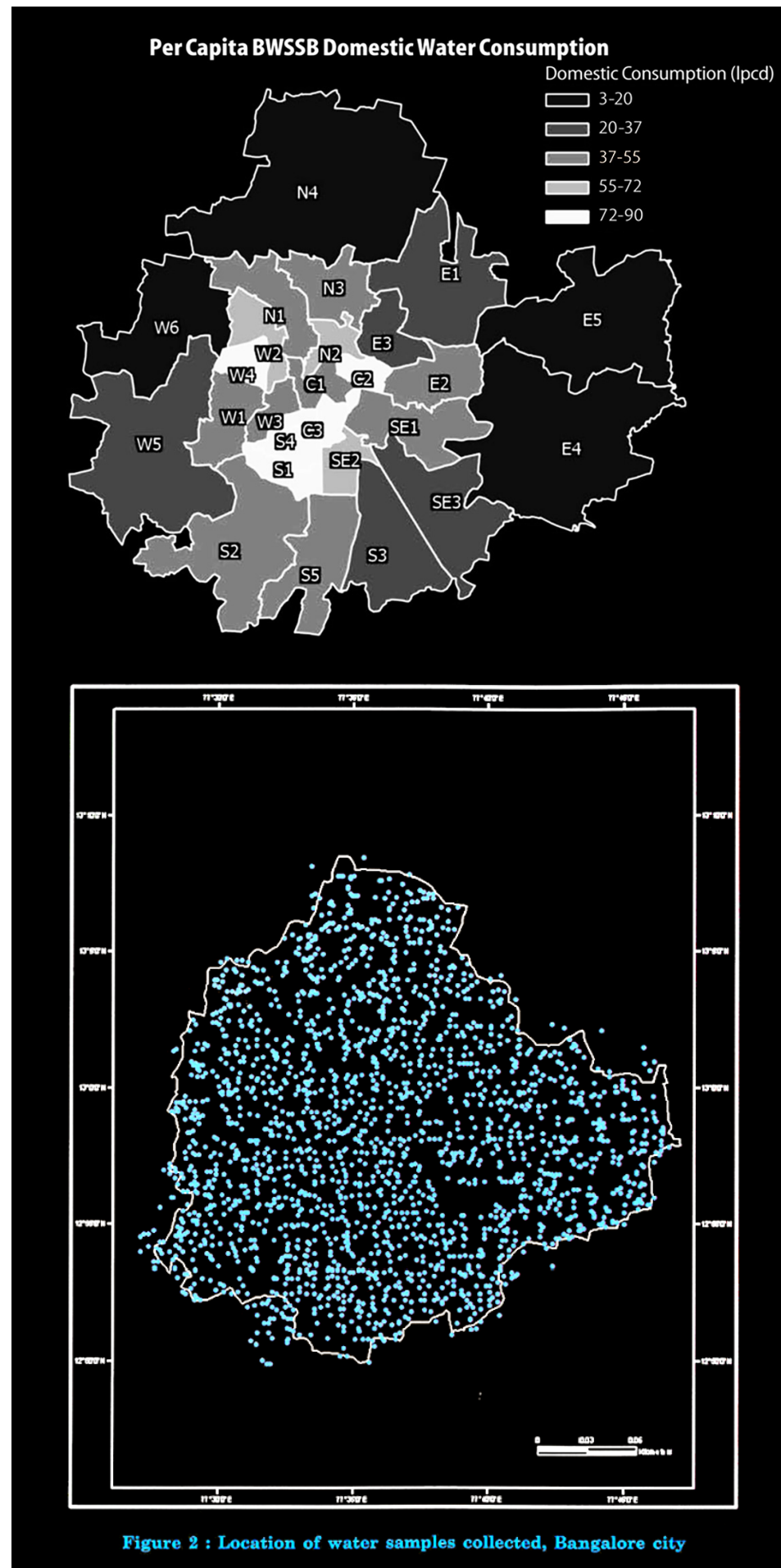


Figure 6 : Watershed Map of Bangalore City

recharge from all sources was estimated to be 1266.8 MLD and total water demand from all sources was estimated to be 1711.5 MLD. Estimate of total recharge and total water demand showed a moderate uncertainty having a CV of 21% and 17%, respectively.



Aluminium (Al):

Alluminium ranging from 0.44 mg/L to 0.97 mg/L (average 0.63 mg/L) is noted in five samples collected in Peenya industrial area. The desirable and permissible limit is 0.03 and 0.20 mg/L respectively. The long term consumption of water with aluminium above the permissible limit causes dementia. Since pH value ranges between 5.49 and 8.94, possibilities of alluminium in groundwater due to lithogenic source is remote

Zinc (Zn):

Normally zinc is not expected in natural groundwater. Zinc is an essential and beneficial element for human growth. The maximum permissible limit of zinc in drinking water is 15 mg/L. The analysis result (Table10 and Table10.1) indicate that of the 275 samples analysed 96% of the samples have the concentration of Zinc between 0.01 and 285 mg/L (averages 2.48 mg/L). The occurrence of Zinc in water samples of the study area are attributed to pollution from industrial effluents. Concentration above 5mg/L can cause a bitter astrignent taste

Lead (Pb):

Desirable/permmissible limit of lead in groundwater for drinking purposes is 0.05 mg/L. In the study area, only 12 samples have detectable level of lead in them. The content varies between 0.01 mg/L to 1.25 mg/L (average 0.182 mg/L). Five samples have shown the lead content above the permmissible limit rendering such water toxic for drinking.

Lead occur in rocks in sulphide and oxide forms. It also occurs in potassium feldspars. Lead in water may be from industrial and smelter discharges or from the dissolution of old lead plumbing. In sulphide form, lead gets into water if present in the rocks during rock water interaction. Higher concentration of lead in groundwater in the samples is attributable to industrial pollution.

Copper (Cu):

Of the 275 water samples tested, only nine samples have detectable concentration of copper between 0.01 mg/L to 1.17 mg/L (average 0.148 mg/L). Among these six are within the desirable limit of 0.05 mg/L and rest of the three samples is within the permmissible limit of 1.5 mg/L.

4. Manganese (Mn):

Generally manganese in groundwater is present in soluble form. The detectable concentration of Mn is found to vary between 0.01 mg/L and 31.2 mg/L (average 0.601 mg/L). The desirable and permmissible limit of manganese in drinking water is 0.10 mg/L and 0.30 mg/L, respectively. The analysis results reveal that 16% of the samples contain manganese above the permmissible limit.

Manganese in groundwater particularly around the industrial area of the city (Fig.17 and Fig.17.1) is attributed to the pollution caused by industrial effluents. Higher content of chloride and total hardness in these samples support the contamination of groundwater due to industrial effluents and domestic wastewater.

5. Chromium (Cr)

Among the samples analysed, 41 have shown the presence of chromium (Hexavalent form) between 0.01 mg/L to 572 mg/L (average 15.91 mg/L). The content of chromium is above the desirable limit of 0.05 mg/L are in 51% of the 41 samples analysed which are to be rejected for it is carcinogenic.

Chromium salts are used extensively in industrial process and may reach groundwater locally through discharge of waste.



Figure : 18
Chromium polluted groundwater
(Peenya Industrial Area)



Figure : 19
Skin eruption due to longer
consumption of Chromium polluted
groundwater (Fig. 18)

The higher content of Chloride, Total Hardness and low pH in association of higher concentration of heavy metals indicates industrial pollution and not lithogenic. The adverse effects like rashes, skin eruption etc., reported in the Peenya industrial area (Fig. 18 and Fig.19) is to be attributed to the long term consumption of water contaminated with chromium above the desirable limit.

Bacteriological Signature of Groundwater

Micro-organisms are the parameters that reflects about the usability or otherwise for drinking purpose. The quality of water is judged on the basis of the presence or absence of total coliforms. Presence of Faecal coliforms is used as indicator bacteria. The faecal coliforms are the part of a larger group known as total coliforms.

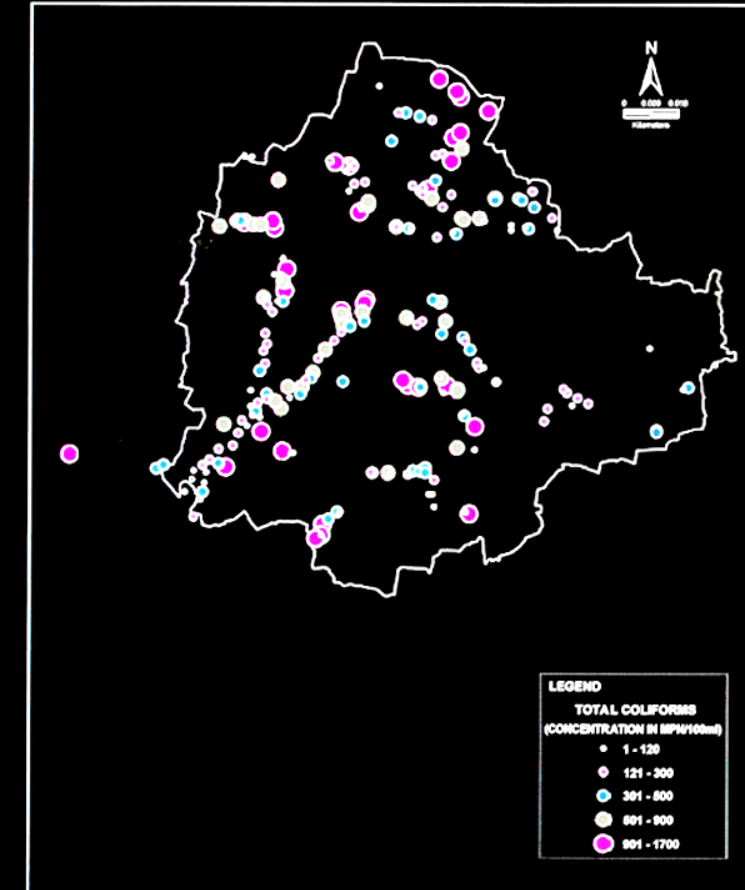


Figure : 20 : Total Coliform and E-coli form in Groundwater,
Bangalore City

Groundwater Pollution in the vicinity of petrol bunks

Eleven groundwater samples were collected in the vicinity of petrol bunks in the western part of the city (Fig. 21 and Fig. 22) based on the public reports about the contamination. Water samples were tested for oil and grease in groundwater. The oil contamination could be noted in all the 11 samples so collected and analysed. Of 11 samples analysed the oil content vary from 33 mg/L to 91 mg/L. The desirable and permissible limit of mineral oil in drinking water is 0.01 mg/L and 0.03 mg/L beyond which it gives undesirable taste and odour to the water.

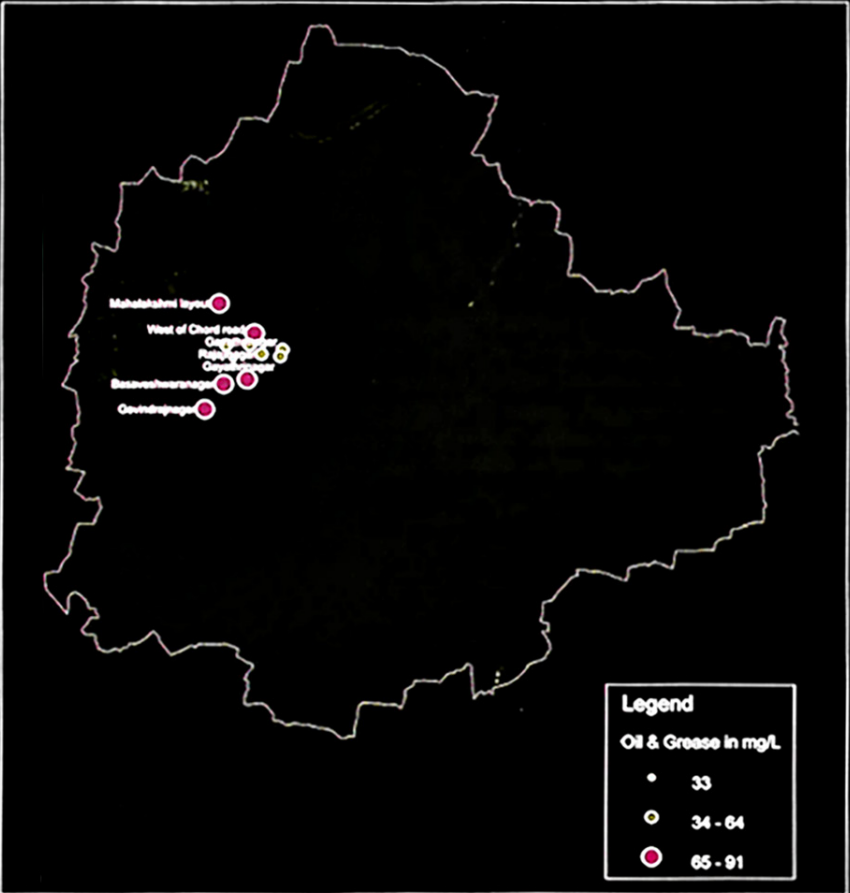


Figure 21 : Oil and Grease in Groundwater, Bangalore city

(d) Total Iron (Fe)

The concentration of total Iron in Groundwater sample varies from 0.001 mg/L to as high as 48.50 mg/L with an average value of 0.53 mg/L. The high content

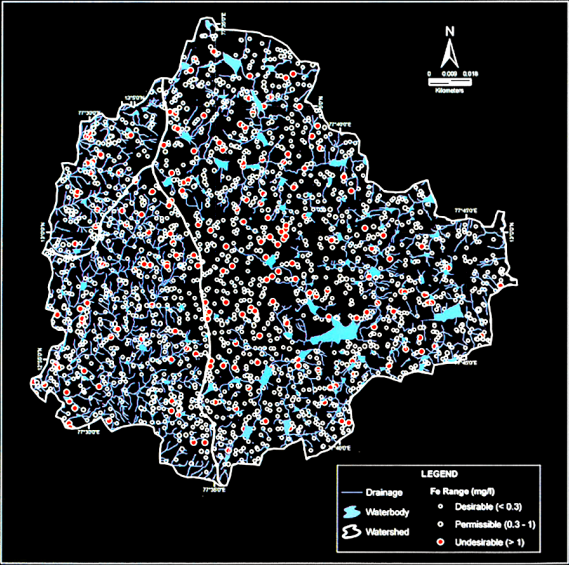


Figure 13 : Iron in Groundwater, Bangalore city

(e) Nitrate (NO₃)

The nitrate content in groundwater varies from less than one mg/L to 554 mg/L with an average of 38.34 mg/L. Out of 2209 samples, 71% have nitrate content less than the desirable limit (<45 mg/L) and 29% (643 locations) have excess of nitrate content(>45 mg/L) rendering unfit for drinking As

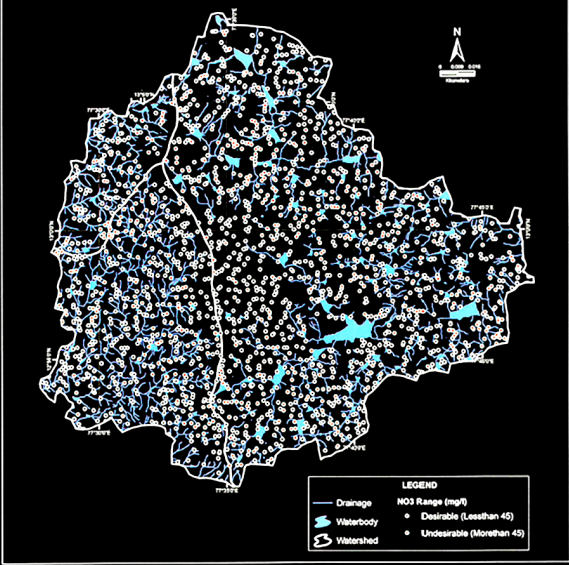


Figure 14 : Nitrate concentration in Groundwater, Bangalore City

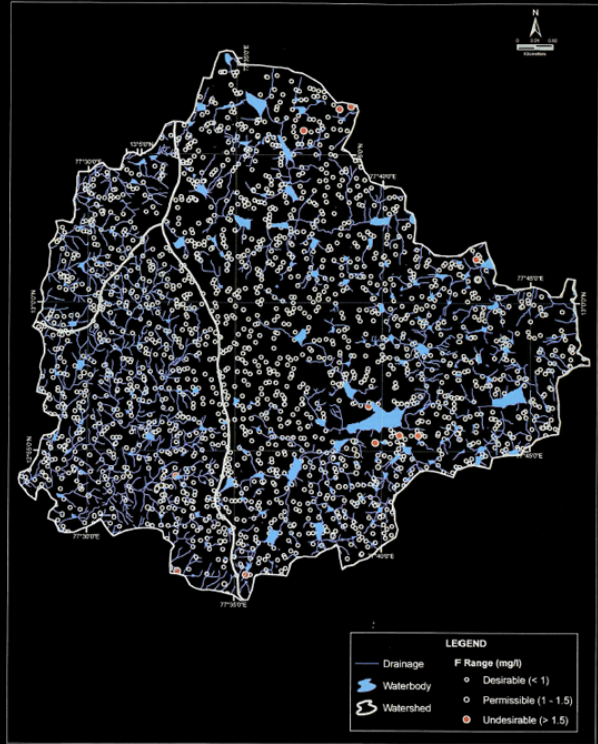


Figure 16 : Fluoride concentration in groundwater, Bangalore city

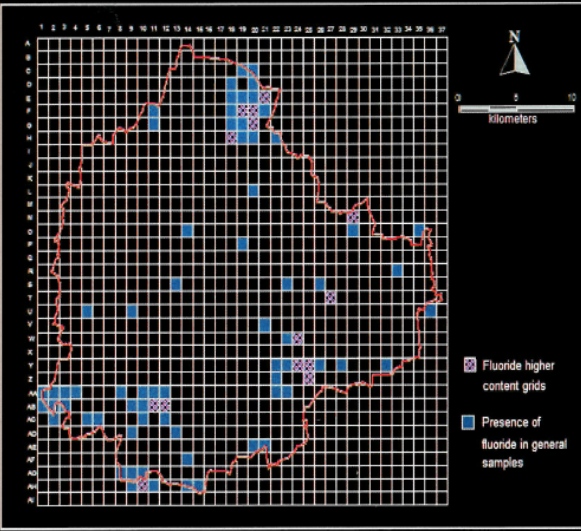


Figure 17 : Fluoride in Groundwater, BBMP area

Location wise and zone wise variation of pH value in groundwaters of Bangalore is shown in Fig. 8, Fig. 9 and Fig. 10.

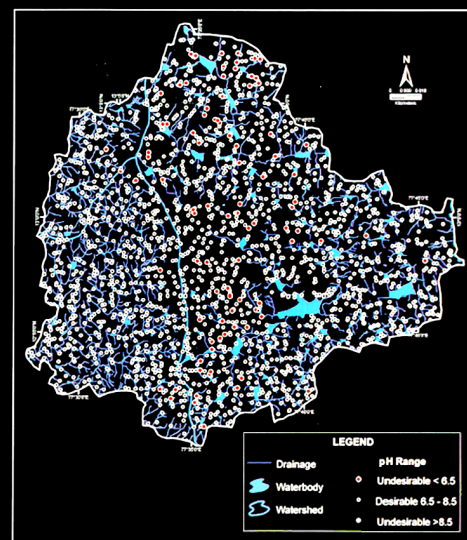


Figure 8 : Groundwater pH, Bangalore City

Total Hardness (TH)

Hardness in water is mainly due to dissolved calcium and magnesium salts. The calcium and magnesium in hardwater contributes to the encrustation that may developed due to changes in temperature and pressure. The bicarbonate ions exist in groundwater as a result of dissolved carbon dioxide. The bicarbonates of Ca and Mg cause carbonate hardness (temporary hardness). The sulphate and chlorides cause non-carbonate hardness (permanent hardness). Total Hardness range from 16 to 2720 with an average of 354 (mg/L). Out of 2210 samples that were analysed, 45% of the samples are within the desirable limit (<300 mg/L), 46% are within the permissible limit (300-600 mg/L) and only 9% in excess of the

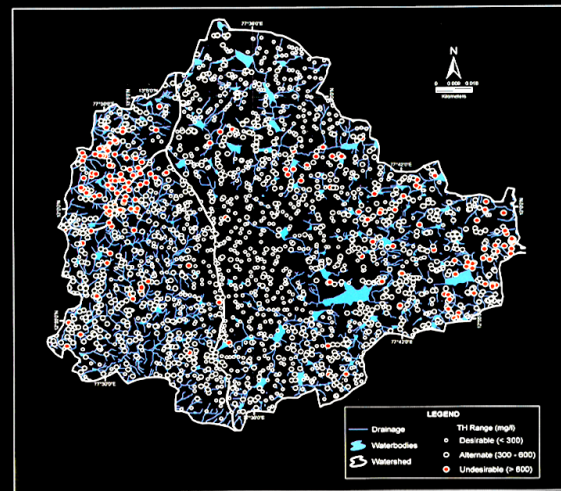


Figure 11 : Total hardness in Groundwater, Bangalore City

Conclusions and Recommendations

From the foregoing account of groundwater quality studies carried out in Bangalore City the salient features that emerged out are:

- the groundwater is Na-Ca and $\text{HCO}_3\text{-Cl-SO}_4$ facies dominant
 - Positive chloro alkaline index (CAI) values suggest that the sodium and potassium in water are exchanged by calcium and magnesium in the rock following Base Exchange reactions (chloro-alkaline equilibrium).
 - The concentration above the permissible limits in case of pH, Total Hardness, Fe, F and NO_3 , heavy metals and bacteriological contaminations indicate pollution due to anthropological activity.
- Measure be taken to prevent pollution from industrial and sewage effluents which are due to anthropological activities
 - Priority be given for conservation of rain water through various rain water harvesting measures
 - Bring awareness among the public towards judicious use of available potable water resources

there were local Indian musicians with whom I might work and build the electro-acoustic ensemble together on-site to perform the data score live in one of the grids measured by Vishal and his colleagues. It turned out that the site of performance is in grid 18, the town centre.

It took half a year of preparation to realise the collaborative performance of three data sets of the water quality at three different sites in Bangalore. I corresponded with the scientists and the musicians for six months and composed the score in close communication with them. With the conceptually fully scored piece – it was the first time that I made the score into video clips that can be played on tablets – I arrived in Bangalore ten days ahead of the performance to get to know the ensemble and performance location and to practise the piece.

The following three images show video stills from the notational videos of the three scores, correlating with the three BUMP water measurement plots in Bangalore:

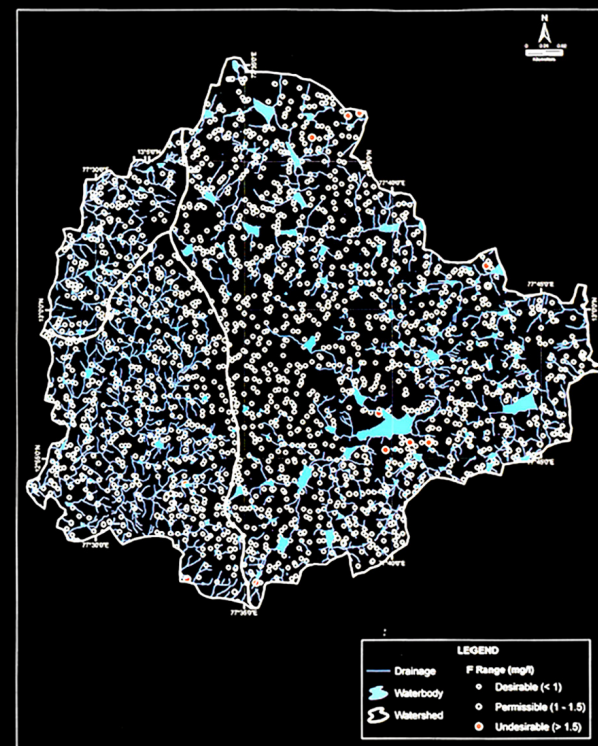
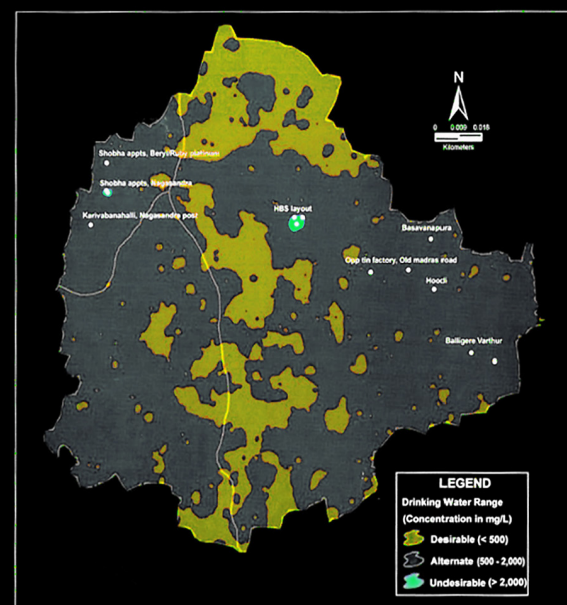


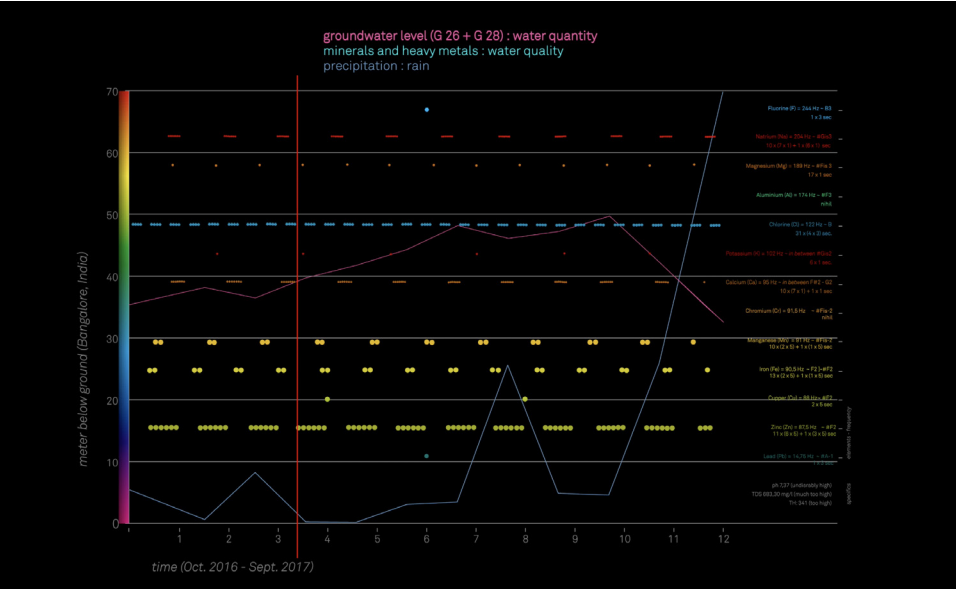
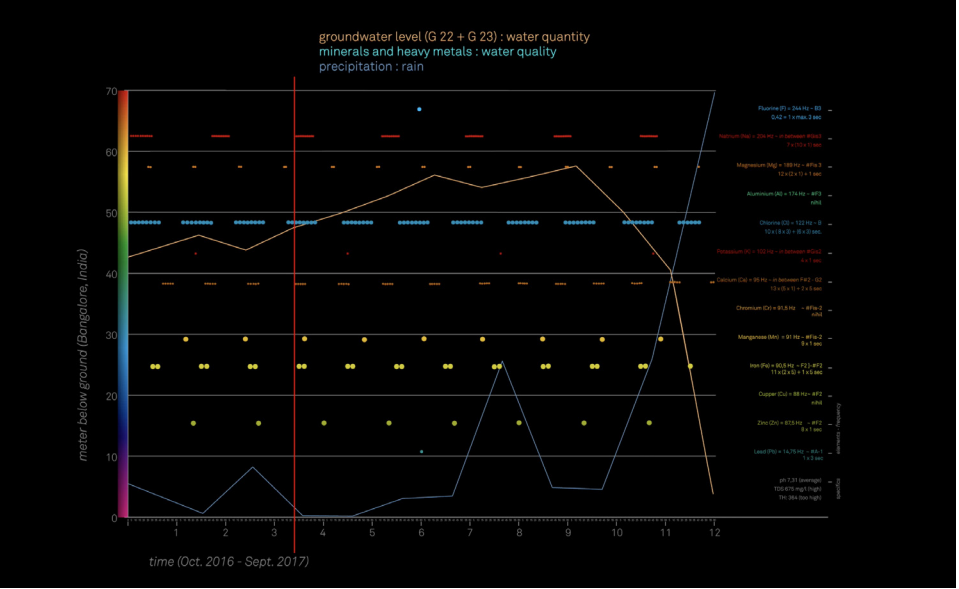
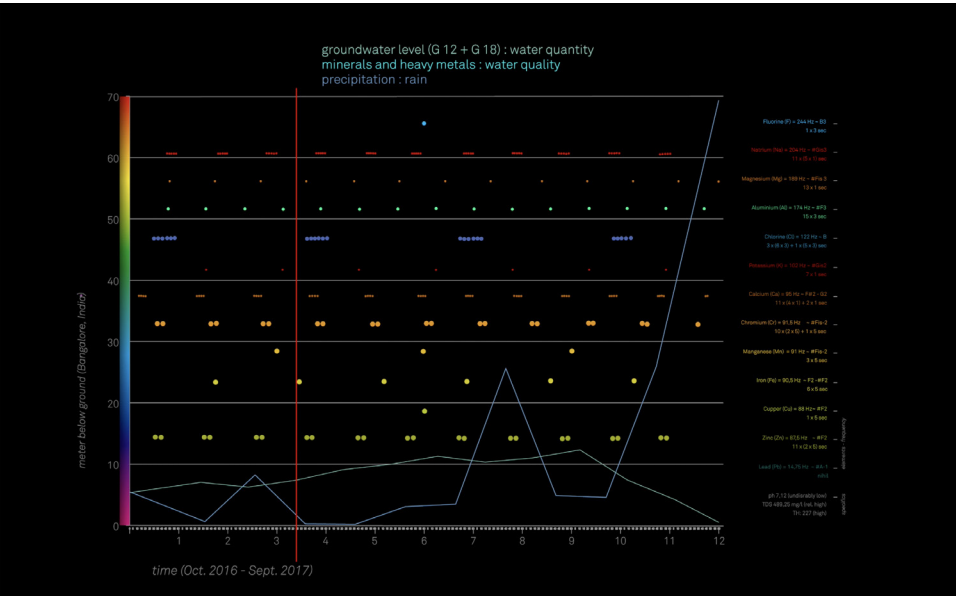
Figure 16 : Fluoride concentration in groundwater, Bangalore city



Video stills from the three video scores
you are variations, version 09

We met in Vashundra's studio and tuned our instruments when Sai started to improvise vividly with the notes on his score. His light play astonished me. All the musicians I had worked with in *you are variations* had great difficulties playing the rather unusual pitch relations, calculated by my ecology of translation from the periodic table. Sai, however, seemed comfortable with the tones and played small ascending and descending tunes with them, explaining that they correspond with an old raga he knows well, raga Jog, one of the hundreds of ragas in Hindustani classical music. The enthusiasm, energy and joy of the musicians involved was unprecedented in my experience. Our encounter pushed the boundaries and created an intense connection and sense of elation.

A raga or raag (also raaga or ragam; literally 'colouring, tingeing, dyeing'¹²⁷) is not a musical scale as we know it in Western music; it is rather a melodic framework for improvisation, akin to a melodic mode in Indian classical music. A raga is also not a tune, because the same raga can yield an infinite number of tunes. Ragas differ in their ascending or descending movements. A definition of raga cannot be offered easily, but it is central to classical Indian music, while it finds no correspondence or translation to concepts in European music traditions:¹²⁸ 'Each raga is an array of melodic structures with musical



motifs, considered in the Indian tradition to have the ability to “colour the mind” and affect the emotions of the audience.¹²⁹ The North Indian raga system

carries a specific signature suggesting a particular time of day or a season, in the belief that the human state of psyche and mind are affected by the seasons and by daily biological cycles within nature’s rhythms; while the South Indian raga system is closer to texts from ancient spiritual Indian traditions. Nowadays, the Indian music system uses about 500 modes and 300 different rhythms called ragas. In the ancient Hinduistic texts the term for the technical mode part of raga was Jati. Later, Jati evolved to mean quantitative classes of scales, while raga evolved to become a more sophisticated concept that includes the experience of the audience. In the Hindu tradition, ragas are believed to have a natural existence: ‘Artists don’t invent them, they only discover them.’¹³⁰ The concept of raga, shared by both Hindustani (North Indian) and Carnatic (South Indian) tradition, is also found in Sikh traditions,¹³¹ and as part of the Qawwali tradition in South-Asian Sufi communities.¹³²

Raga Jog bears resemblance to raga Nat (Nattai, Naata) of the Carnatic (South Indian) tradition.¹³³ Classically, raga Jog is sung late at night or in the small hours of the morning, just after midnight. ‘Jog’ indicates a state of enchantment. It evokes tranquillity and *bhakthi*, devotion. In a remarkable occurrence worth remembering: the mathematical pitch calculations from 2011 for *you are variations* coincide with this ancient, classical raga in Indian music.

Distant histories and different temporalities seem to converge. When *you are variations* brings data back, does it do so not only spatially, but also temporally? The water quality data from the BUMP research project in Bangalore – transformed into a musical score and performed site-responsively together with Indian musicians on site – when brought back to the place in which they originate, reveal a profound connection between musical systems that are conceived in utterly different contexts, traditions and circumstances. I experienced intense movement of the project’s trajectory, simultaneously forward and backward.¹³⁴

¹³¹ Such as in Guru Granth Sahib, the primary scripture of Sikhism. See Kapoor, 2005, pp. 46–52.

¹³² Salhi, 2013, pp. 183–84.

¹³³ Raga Jog is assigned as a member of Kafi (Kāfi), one of the ten basic thaats of Hindustani music from the Indian subcontinent. It takes Raga Tilang for its base, which itself is derived from Khamaj.

Performance stills, documentation, BeFantastic, Rangasthala, Rangoli Metro Art Centre, Bengaluru, India, 17 December 2017, 2 min 37 sec, <https://vimeo.com/263476433>.

Contextualisation

Connecting Contexts

Akin to the tree, reaching from below ground to the sky and back, *you are variations* exceeds the art context, transgressing and simultaneously relating multiple frames of references. Attending to its cross-connections, the following chapter investigates the physical, corporeal, perceptual, cultural and ecological resonances of the sound in *you are variations*, weaving a fine thread into and from historic, climatic, aesthetic, discursive, social, political

¹³⁴ *you are variations*, version 09 – Neerinusiru, performance documentation, <https://vimeo.com/263476433>.

1

²⁷ Raga (Sanskrit: ‘the act of colouring or dyeing’, or simply a ‘colour, hue, tint, dye’). The Sanskrit word *raga* has Indian roots, as **reg* – which connotes ‘to dye’. It is found in Greek, Persian, Khwarezmian and other languages, in variants such as ‘*raxt*’, ‘*rang*’, ‘*rakt*’ and others. The words ‘red’, ‘rot’ and ‘*rood*’ are related. See <https://en.m.wikipedia.org/wiki/Raga>.

¹²⁸ Or does the raga have a distant relationship to how Christina psalms work in terms of how they are notated and then flexibly executed by a church choir in relation to the text they are being applied to? Many thanks to Jon Thomson for this interesting association.

¹²⁹ See <https://en.m.wikipedia.org/wiki/Raga>.

¹³⁰ Dalal, 2014, p. 323.



Sai Chandrashekar – tabla, darbouka, ghatam
Vasundhara Das – voice
Christina Della Giustina – electronics
Liu Ting Chun – programming

you are variations, version 09 - Neerinusiru, 2017
Rangasthala, Rangoli Metro Art Centre, Bengaluru, India (video stills)



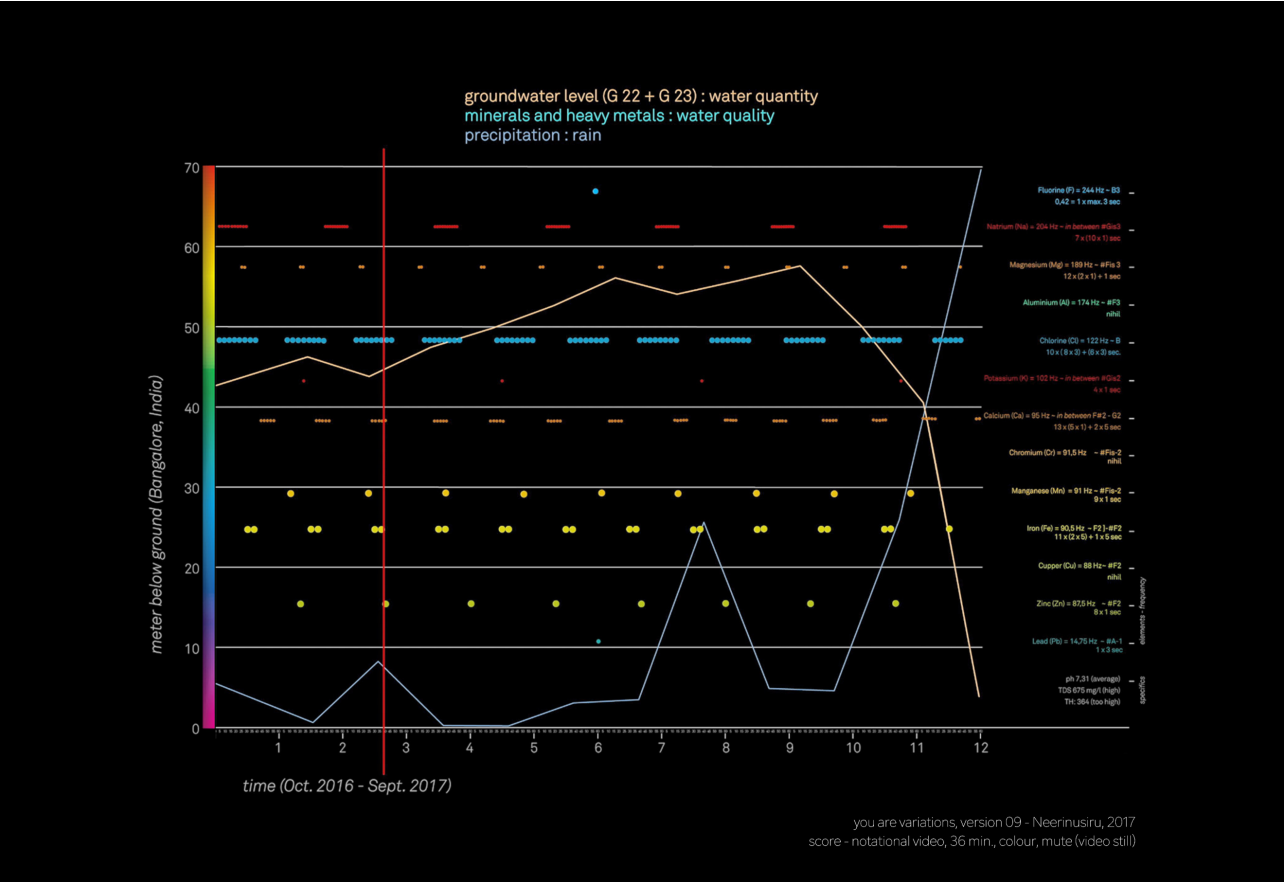
you are variations, version 09 - Neerinusiru, 2017
Rangasthala, Rangoli Metro Art Centre, Bengaluru, India (video stills)

and spiritual frames of reference. Some references within these frames seem obvious, others dwell in the background, and still others are neither evident nor apparent at first, while already soaring around, unremarked on, for some time. Thus, some references are conscious, intentional and powerful, or subliminal and latent; others are unknown, or not known yet, even though they are effectively operative. To inventively link these diverse more and less-conscious contextual frames is difficult, certainly in a scientific culture that highly prioritises distinction and specialisation. But it is urgent: the tree as a whole cannot be grasped by separating it into compartments of knowledge. A different approach is vital.

To allow for connections that are not recognised and not yet formulated, the chapter is structured cyclically. It starts and ends at the

interrelated topics ‘tuning’ (as a form of listening to the world) and ‘listening’ (as a form of tuning oneself to the world), reminding and invoking the gifts that they harbour.

Tuning - *Becoming One*



you are variations, version 09
score reinforcing the concept of vertical relations

The tuning practice and the theoretical base of its tuning system are equally relevant in *you are variations*.¹³⁵ The distinct and peculiar tuning system is based on the chemical properties of the elements as ordered in the periodic table. It refers to the long and not exclusively Western history of tuning systems that deviate from the Western twelve-tone equal temperament,¹³⁶ while still attending to the mutual relationship of notes, their relation to the root and the ratio of the presence of certain chords with respect to the presence of others. The tone-setting process based on arithmetic relationships between different tones, renders it not atonal music, but a form of micro-tonal music.

¹³⁵ See detailed description of the tuning system in the chapter ‘Methodology’.

¹³⁶ Harmony in the Western sense is a comparatively recent invention, having a relatively limited geographic spread. Traditional Indian systems of 22 *śruti* (‘shrutis, also called ‘heterotones’), Indonesian-, Thai-, Burmese Gamelan, African music, music using just intonation, meantone temperament and other alternative tuning systems are considered microtonal, while microtonal variations of intervals are practices in Afro-American spiritual, blues and jazz. They are rarely studied as teleological in relation to their harmonics.

¹³⁷ The Italian Renaissance composer and theorist Nicola Vicentino (1511–76) built a keyboard with 36 keys in microtonal intervals to the octave (known as *archicembalo*), a circulating system of quarter-comma meantone progression, maintaining major thirds tuned in just intonation on all keys.

¹³⁸ Alternatives to dominant Western tuning systems are proposed by Marsilio Ficino and Robert Fludd, and in Arnold Schönberg’s dodecaphony (1923). Schönberg developed atonality – what he called pantonality – a deliberately toneless music in which no tone is more important than the other. See also Harry Partch, Karlheinz Stockhausen, Ernst Krenek and John Cage; the work of Catherine Christer Hennix and Wendy Carlos, and Éliane Radigue’s micro-shifts in her spiritual *proposition sonores*; La Monte Young’s *dream house (Nada Brahma)* and Tomoko Sauvage’s waterbowl drones *Musique Hydromatique* (2017) (inspired by the Indian Carnatic Jālaṭharāṅgini in which porcelain bowls are ‘tuned’ with water and amplified by hydrophones as bewildering electro-aquatic instruments). Contemporaries of neo-tonal, repetitive music with not-reactionary sounding scales are Meredith Monk, Mary Jane Leach, Lois V Vierk, Richard Skelton and Antonina Nowacka (known for ambient, electronic, experimental drone and part of the duo WIDT).

¹³⁹ Music may be understood as having both vertical (teleological) and horizontal (time-based) features. The horizontal aspects are those produced and proceeding during time (tune, melody, counterpoint, rhythm, process, succession, phasing, etc.). The vertical aspect point to the sum total of what occurs together at any given moment in time: the resulting

Microtonality emerged in the 1930s and was greatly facilitated by the development of electronic music.¹³⁷ Together with the appearance of acoustics, its technological approach and scientific explanation, it sidesteps the traditional European need to theoretically legitimise notational musical systems with reference to conceptual frameworks and/or mythical cosmologies. How exactly microtonality historically side-steps musical legitimations is a very intricate question that goes beyond the scope of this thesis. However, the developments in the histories of the Western musical scale towards the emergence of microtonality directly relates to the modern loss of ‘mythical cosmology’ and gain in ‘scientific argumentation’.

Since then, many theorists, composers and musicians explore the possibilities of deviating intervals that are smaller or have smaller partial values than the predominant semitone intervals in Western music.¹³⁸

However, many of these cultures and composers keep practising ‘vertical’ musical relations.¹³⁹ South Asian Hindustani and Carnatic art music, for example, is frequently cited as placing little emphasis on what is perceived as harmony in Western practice, while tuning is essential.¹⁴⁰ The underlying foundation for most South Asian music is the drone, a held open fifth interval (or fourth interval) that does not alter in pitch throughout the course of a composition. Pitch simultaneity in particular is rarely a major consideration, even if many other considerations of pitch are relevant to the music, its theory and its structure, such as the complex system of ragas, for example, which combine both ascending and descending melodic and modal considerations and codifications within it. When we performed *you are variations, version 09 – Neerinusiru* with the Indian classical musicians Sai Chandrashekar (tabla, darbouka and ghatam) and the Hindustani trained experimental singer Vasundhara Das (voice),¹⁴¹ remarkably they recognised the musical scale, and further, identified the tune as raga Jog.¹⁴²

The primary material of *you are variations* is scientific measurement – data of recordings/measurement material output – rather than the recorded item itself, rendering it not sonification but fully scored composition with its own tuning and notation system.¹⁴³ Its goal though is to craft a way to move with and remember trees by creating minimal,

polyrhythmic sonic flux. The results are immersive, durational auditory fields, timbral compositions that are not alike but attuned to trees. In acknowledging trees as complex, living, ancient and continuous organisms in the world, these sonic renderings create palpable, acoustic slow-motion happenings in sculpting tree-matter sonically and durationally, drone-like.¹⁴⁴

you are variations can be also described as drone music, emphasising extended continuous change with the use of repetitive, gradually shifting tone clusters. Its vibration is characterised by the sustained repetition of tiny sound clusters: not a harmonic narrative that starts from zero, but a generative organism that is *already here*, alive, holding a fountain of infinite sound permutations, while releasing *variations*. Its effects happen in an osmotic act within the physicality and awareness of the listening body and its being in touch with the world: the drone in *you are variations* unfolds *with* the body and mind of the listener, in-relation of tree with self. The performance space, the musical instruments, the musicians’ bodies, the audience’s presence, together work as media – that is, bodies – through which vibration is held, shared, played with and experienced.

Since *you are variations* follows the circadian rhythm of trees – often playing a 24-hour-day cycle in 24 minutes – at night it comes almost to a halt, although silence never appears completely. During mornings and evenings, it is often rather slow for long periods of time. It accelerates and decelerates only briefly around noon, for approximately 4 minutes per musical piece. By creating long interrelated cycles, the work tunes into the trees’ pre-existing plural relations to the sun, the moon, the Earth, etc., simultaneously creating zones of contact between tree, instrument, musician and listener.

The prototypes of *you are variations, version 08*, serve as useful examples for co-creating aural contact zones in the form of an interactive light installation, a choir, and a drone sustaining my speaking voice: all employed to experiment with intersection, relationality and their affinity to becoming one, that is, becoming related in plural.

events of notes sounding together, alongside or against each other at any instance. In the implied contrast, the basic tuning system traditionally is understood as a vertical phenomenon.

¹⁴⁰ With respect to ‘harmonics’ in the tempered scale, dynamics between frequencies are held back in the European understanding of tuning. The rich and very much alive and resonant sound of Indian music requires great sensitivity and experience, also in the actual tuning process: the fundamentals are of lesser interest as attention is drawn to the sustained harmonics that should be clearly audible, particularly the octaves, fifths, major thirds and minor sevenths of the (fundamental) tone of the string. The actual tuning of the Jivari (overtone-rich buzzing of classical Indian instruments) is done on three levels: firstly, by means of the large pegs; secondly, by carefully shifting tuning-beads for micro-tuning and thirdly, on a tanpura, by even more careful shifting of the cotton threads that pass between the strings and the bridge, somewhat before the zenith of its curve. The Javari of a tanpura is in a way fine-tuned with a cotton thread under the string. Both the thread itself and its function is called ‘jiva’. In Hinduism, jiva (Sanskrit: IAST, jīva) is a living being or any entity imbued with a life force. The word itself originates from the Sanskrit verb-root *jīv*, which translates as ‘to breathe, to live’.

¹⁴¹ Performed with Liu Ting Chun (programming) and Christina Della Giustina (electronics) *Neerinusiru* is composed with data on Bangalore’s water quality. See *you are variations, version 09 – Neerinusiru*, performance documentation, *op. cit.*

¹⁴² This raga bears resemblance to raga Nat (Nattai) of the Carnatic tradition. Classically, raga Jog is sung in the small hours of the morning, just after midnight. ‘Jog’ indicates a state of enchantment evoking tranquillity and devotion.

¹⁴³ Or a form of sonification, not the ‘reality’ or ‘nature’ out there, but its scientific rendering, scientific data. The project is highly critical towards technology-based forms of sonification of environments as capturing the actual life of organisms

on Earth. Nevertheless, at times sonification methodologies are not employed in a naively realistic and/or representational way, but rather for the sake of another sonic perspective, that is, as a conscious form of (technological) translation, such as the work of Andrea Polli, David Monacchi and Jana Winderen, etc.

¹⁴⁴ See the etymology of the term ‘drone’, related to ‘ode’, ‘audio’, German ‘*dröhnen*’, etc. According to La Monte Young’s definition from 2000, ‘the sustained tone branch of minimalism’ (Young, 2000, p. 27). Minimal drone music activates a radically fluid experience. Contrarily, Western music tradition starts with the idea of silence: notes and frequencies are added over silence from a linear perception in order to construct something from an apparently blank, clean space, creating a composition through a sequential notational system that ‘did not exist before’. Drone music takes its principles from Indian classical music, from the sustained sound of the tambura. The premise is based on the idea that ‘sound is always, already there’ happening through a field of continuous electricity. The body can tune in with that other sonorous body-mass in order to create a new state of singular synchronicity, a collaborative act between vibration and individual. Here the body listens attentively to the accumulation of vibratory frequencies in order to tune into the sonic continuum and, from that place, articulate its own experience. There is neither a priori imposition, nor an anticipated idea, agenda, intention or desire, there is only relation and interaction with frequencies that are already permeating every space, every aspect of sound, everyone. The most penetrating vibration is already there, within us, between sound and bodies, creating a synchronicity open to semiotic mystery, producing subjects that experience and experiment themselves in-relation, entering into an osmotic condition from a continual, subjective exploration, an internal interpretation, and not from a prosthetic semiotic limitation, a rhythmic control: a model that erodes singularities, as well as union.

¹⁴⁵ I came to know about the work of Catherine Christer Hennix during my studies in early 2018 while writing this

Present-day composers and musicians working with (post-)

minimal drone-like sound differ significantly from each other, but what they

do have in common is the awareness of and curiosity about sonic flux as a

prehistoric flow of sound that precedes and exceeds human existence. It

substitutes what the West calls ‘music’ with sound’s eventful and healing

relational matter, breath and effects.

Catherine Christer Hennix is a composer who makes no

concessions with regards to the spiritual inclination of her work. In her

experience, the artist is nothing but a medium for such flux; and it is only

gracefully that we can attend to it when invited to vibrate with the world. It is

a blessing. The insights gained and shared are contact, healing and wholeness:

political gifts worth pursuing.

It is an aesthetically remarkable analogy to Hennix’s method

of working that in all four prototypes and all three interpretations of *you are*

variations, version 08 – performed between September 2016 and October 2019

– a delicate, but distinct cloud of frequencies is already in the space when the

audience enters the performance space – the sum total of the frequencies of

the spruce tree’s composition in terms of its material, elemental composition.

At the end of the first part, this sonic veil slowly transforms into the sum total

of the frequencies of the beech tree’s composition in terms of matter, and

the second part begins. At the end of the piece the audience leaves the room

filled with frequencies calculated from the beech tree. The careful base-level

interactions between small clusters of frequencies is foundational to the

work.¹⁴⁵

Further, in Hennix’s work electronics provide a base drone, with

acoustic sounds played by instrumentalists to accentuate tiny musical features

with utmost attention given to the interplay and integrated whole. Likewise, in

you are variations the electronics process all data, as elaborated in the following

paragraphs, while instrumentalists highlight specific properties with full

attention given to wholeness on multiple levels of interplay.

When asked by Joshua Minsoo Kim in an interview for *Tone Glow*,

what her biggest takeaway was from her studies with Pandit Pran Nath, Hennix

replied: ‘it connects you with the whole universe and beyond. In other words,

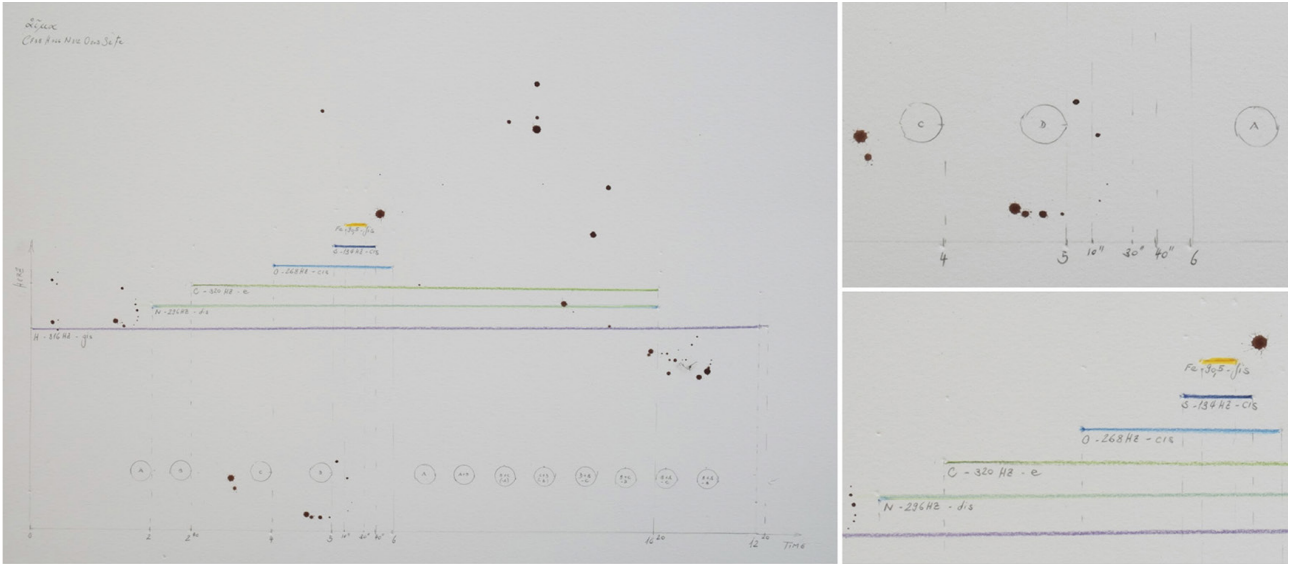
you don’t perform for the audience, you perform for the universe. It’s a form of

prayer, actually.’¹⁴⁶

thesis and had the opportunity to attend the premiere of her performance *Blue(s) in Green to the 31 Limit*, on 16 and 17 February 2018 at Stedelijk Museum Amsterdam featuring herself and other musicians: Benjamin Duboc, Rozemarie Heggen, Hilary Jeffery and Marcus Pal.

¹⁴⁶ Catherine Christer Hennix interviewed by Joshua Minsoo Kim, *Tone Glow* 028, 24 August 2020, <https://toneglow.substack.com/p/028-catherine-christer-hennix>

Electro-Acoustics - *Both*



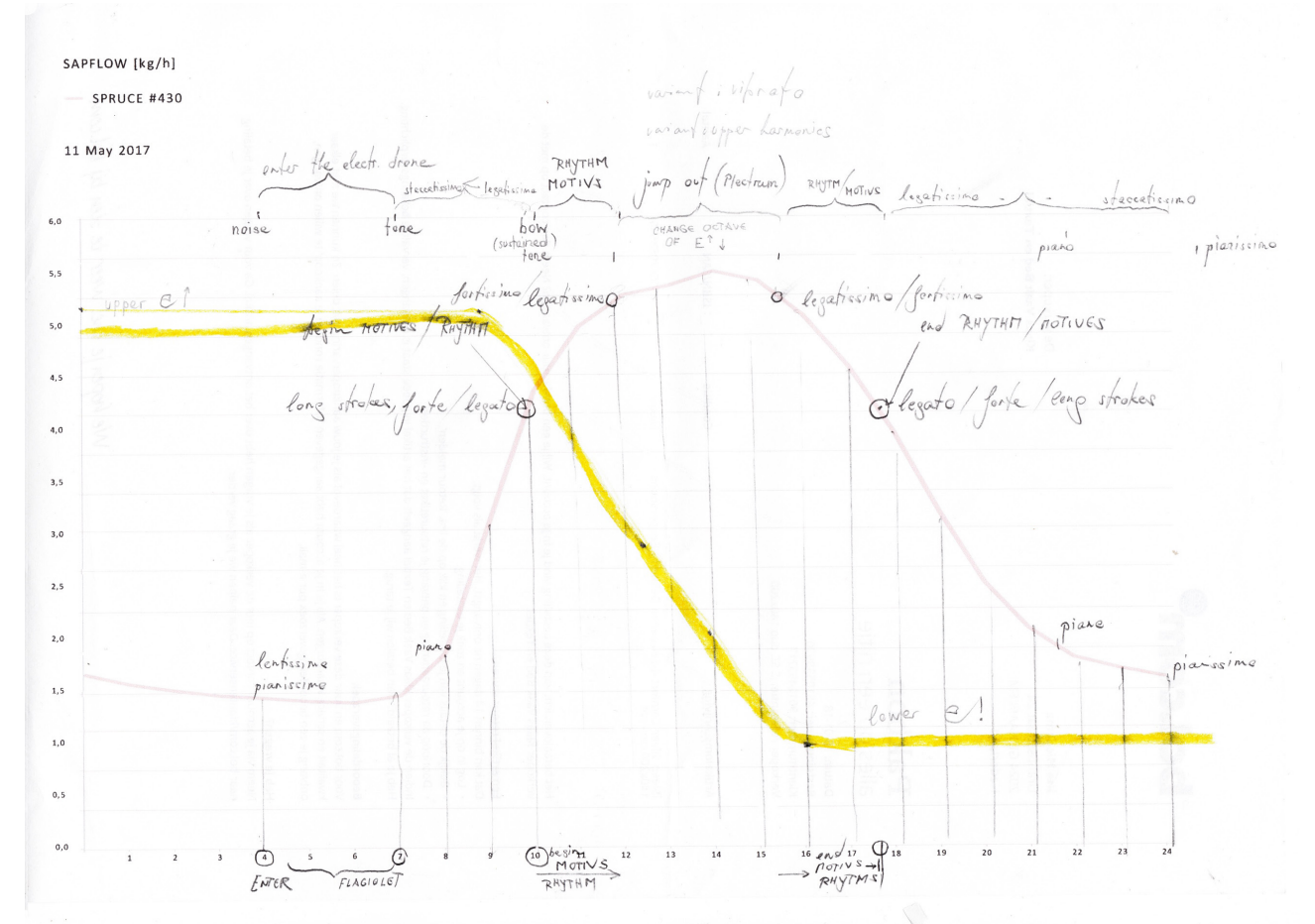
you are variations, version 08, prototype 05 – $\alpha\mathbf{i}\mu\alpha$, 2016
score (colour pencil on aquarelle paper, A3), performed at AIDS monument and exhibited at OBA, Amsterdam, NL, in collaboration with students HKU Conservatory (example pages)

you are variations, version 08, prototype 05
parts of score reinforcing the concept of horizontal relations

The pitch relations discussed above refer to the ‘vertical’ aspects of music, emphasising the connection of chords, with tonality as the perception of relationships among the tones around a perceived fundamental note as tonal centre, that in the compositional concept of *you are variations* links directly to its use of the periodic table. The ‘horizontal’ aspects of music relate to processes and procedures that unfold over time.¹⁴⁷ The polyrhythmic repetitions and complexities in *you are variations* find their source in the permutational (infra-)structures of molar configurations in organic chemistry, rendered as minimal – spectral – and process-driven electronic music.

¹⁴⁷ Historically it led to interdependence, sustained tension or integration between the vertical and horizontal dimensions of music.

The binary in this conventional dichotomy, together with the usual preference towards either of these musical properties, are rejected, superseded by a vibrant and inclusive continuum. It is a similar rejection with regard to either predominant harmonic or melodic dimensions, which are replaced by attention to both vertical and horizontal musical aspects, that is, to a sonic sphere.



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Indeed, the specific tuning in *you are variations* coincides with unusual sounding qualities: the acoustics are rich in contrast, friction, relief and tactility, fusing with the fine, compact density of the electronics. Regarding its instrumentation, over the past decade *you are variations* has been working with diverse clusters of prepared, pitched instruments, combining:

- singing saw
- bass clarinet
- oud
- tambourine
- electronics
- glass harp
- saxophone, bass clarinet
- cello
- stone-, bamboo- and knotweed-percussion
- electronics
- glass harp
- marimbaphone
- bass clarinet
- oud
- cello, violin
- voice
- electronics
- glass harp
- stone-, bamboo- and knotweed-percussion
- calabash, gatham, bendir
- shakuhachi
- voice
- electronics
-

- double bass
- oud
- paper
- electronics
- voice
- tabla, darbouka, ghatam
- electronics
- voice(s)
- electronics
- flute
- double bass
- violin
- vibraphone, marimbaphone
- electronics
- flute
- cello
- violin
- vibraphone, marimbaphone
- electronics

The instrumental choices, their histories and their timbres are chosen also to highlight the eminent role trees and plants play in physically shaping instruments and transducing sound. The predominance of wood instruments directly colours the sounds produced in the pieces and expands the variety of qualitative sound outputs co-produced by timber and timbre.

It centres on the different acoustic properties inherent to the wood of trees – anatomic, morphological, dendrological physics, density, regularity, size, etc.

– that enable vibration and diffusion, relating again forest culture to physical sound.¹⁴⁸ *you are variations* brings together (the resonant characteristics of)

wood, musical techniques and compositional practice that in ensemble conceive

the resonant and conductive qualities of trees. Once the musicians’ and the

woods’ timbres sound together, the tree can be heard and felt.¹⁴⁹

The aim of *you are variations* is immersive: to get inside the wood, the tree,

the sound, rather than hear it as a progression, a narration, a figure or a form.

The acoustics in combination with the electronics create the experience of

an intense, hovering swirl. It is not so much a shift away from structure, but a

deliberate fusion of a highly detailed and networked architecture on the macro

scale, and a vibrating sound-cloud full of peculiarities on the micro scale, that

together create a highly enveloping potential for immersion.¹⁵⁰

¹⁴⁸ In string instruments especially this importance is widely recognised. The properties of wood serve to transmit and radiate the vibration of the string, acting as a ‘medium’ that colours the timbre. Accordingly, the timber of trees used in traditional Italian strings is called ‘Abeti di Risonanza’. Their location and external climatic conditions generate specific sonic characteristics in the timber. Many musicians and artists, a.o. Laurie Anderson (*Handphone Table*, 1978) and Doug Aitken (*Sonic Table*, 2012), used the physical properties of timber, such as acoustic velocity, as a basis for sound sculptures, sound installations, etc. Research into the qualities of timber reveals plenty of shared interest and histories between bioacoustics, instrument building and the sonic arts. The xylophonic phonograph experiments of the 1960s, including John Cage’s *Cartridge Music* (1960), connects early plant bioacoustics, hardware hacking and experimental sound. Recording directly from plants and living trees, Patrick Farmer and Robert Birch – among many others – focusing on the vibrational quality of living trees. In my own work, further musical aspects of trees in the wind, similar to Aeolian instruments, have been explored in the series *tree studies* (2007).

¹⁴⁹ Timbre, from French ‘quality of a sound’, ‘sound of a bell’, ‘bell without a clapper’, originally a ‘small drum’, probably from the Greek *tympanon* or ‘kettledrum’; from the root ‘*typtein*’, ‘to beat, strike’ (also related to ‘type’). See <https://www.etymonline.com/word/timbre>.

¹⁵⁰ Mamoru Fujieda’s minimalist tradition of composing based on data taken from plants combines alternative tuning systems (just intonation, Pythagorean) with ancient instruments of China and Japan, such as the shō, koto and the twenty-five-stringed zither hitsu, creating a mixture of sounds reminiscent of European medieval music, Asian traditions and modern science.

Listening - *Becoming Many*

In kindergarten I listened to the gong the teacher struck every morning.

It is the listening to sound disappearing.

It took me to the border of reality and imagination.

When did I stop hearing the sound?

When did I stop listening?

When does memory begin?

– Quote from my diary, 17 August 2015;

The data *you are variations* works with – calculations from soil-, dendrochronological- and eco-physiological research into the long-term effects of climate change as measured in trees refer to an engaged scientific and aesthetic ecopolitics. A range of diverse forms of environmental soundscapes and acoustic ecologies are widely (re-)occurring in present-day art and sound practices. Even if individually they differ greatly, for instance, regarding their specific discourses or their aesthetics, they all point to listening as an eminent practice. This qualitative exercise in listening, understood as generating reciprocal relationships, is what *you are variations* also proposes. Perhaps the range of todays practices can be differentiated among two firmly interrelated – but at the same time distinct – strands: one strand trained on the difference between searching, finding, recording and processing sound as with most microphones and other sensing technologies that capture vibrations; and the other strand having to do with making sound in bringing instruments, tools and voices into vibration. Both strands relate to hearing and listening: in sonifying anthills, a coral reef, with cacti, etc., the aim is to hear, a hearing that refers to the source of the sound, creating representational sounds and music¹⁵¹. An artist deeply concerned with the difference between hearing and listening, Pauline Oliveros,¹⁵² wrote that ‘Hearing is the passive basis of listening... listening is a constant interplay between the perception of the moment – with

¹⁵¹ Bernie Krause has recorded natural sounds since the 1970s and has accumulated many hours of recordings from all over the globe. They powerfully illustrate situated issues of climate change over long periods of time. Bernie Krause, contribution to World Listening Day, 18 July 2015, <https://www.worldlisteningproject.org/world-listening-day-2015-with-bernie-krause/>.

¹⁵² Interactive musician, improviser and composer; teacher; writer; yogi, karate, t'ai chi and qi gong master; founder and organiser; humanitarian, messenger of peace and non-violence.

performance space as important as voices and instruments – compared with remembered experience.’ In her case it led her to a practice she called ‘deep listening’, later in her life theorised as ‘quantum listening’:

Deep Listening represents a heightened state of awareness and connects to all that there is. ... Deep Listening is exploring the relationships among any and all sounds whether natural or technological, intended or unintended, real, remembered or imaginary. Thought is included ... Two modes of listening are available – focal and global. When both are utilized and balanced there is connection with all that there is. Focal listening garners detail from any sound and global listening brings expansion through the whole field of sound ... Deep Listening includes the environmental and atmospheric context of sound. ...

Quantum listening – a theory derived from the practice of Deep Listening – is listening to more than one reality simultaneously ... Listeners practicing cultural flexibility would be aware of the profound interdependence of all beings and all things. A new music reflective of a new humanity with a high value on life could arise.¹⁵³

Oliveros also calls the heightened concentration on specific sonic events, ‘exclusive listening’. She does so while staying aware of the entire contextual sound field of the event, what she calls an ‘inclusive listening’ that includes everything. Her works are invitations to intensely connect and explore the world and ourselves through sound, always with an eye towards healing and health via body-centred listening exercises in receiving (calmness) and giving (communion) sounds. She cultivated music’s most basic capacity to revive our awareness of ourselves, each other and the wider world, with an unprecedented emphasis on relation and collaboration, and this is of direct importance for *you are variations* research.

The question at stake is ‘can we learn to *listen* to trees?’,¹⁵⁴ not ‘can we learn to *hear* trees?’.

The concept of being ‘one ear’ can be traced back to Wagner, Mahler, John Luther Adams, etc., as well as to Hildegard Westerkamp. In her sound-walks with the field-recording microphone – or just with oneself as a ‘moving ear’ – through rural, below-soil and urban environments, explore

how opening our ears to our surroundings creates presence and opens the mind: ‘Acoustic ecology or soundscape studies [consists of] the study of the inter-relationship between sound, nature, and society. ... Listening will help us reconnect to the environment. If we can understand what listening can do to reconnect us to our environment, we can understand what’s happening to our environment.’¹⁵⁵ In particular, she understands sound as experience of *place*, as the main source and capacity to create a connecting and nourishing bond between subjectivity and the world.¹⁵⁶ Her writing is activated by the same awareness: ‘Western music mainly focused on abstract, autonomous sonorous objects – music strictly conceived as organized sound, erased from the listener’s relationship to the actual world. ... Western aesthetics separate the experience of music from its social context. When one is moved by the music in that sense, one is moved internally, privately, as an individual.’¹⁵⁷

you are variations very much shares this notion of acoustic ecology developed by Westerkamp and others, which aims at reconfiguring the lost links between human and environmental worlds through sound. However, perhaps it is the Soundscape Ecologists’ instrumentalisation of sound, together with its categorising differentiation between geophysical sounds, biological sounds and human sounds that creates difficulties. In any case, unfortunately there is a didactic, educational endeavour, a hierarchising, an uncritical attitude towards conservation and a moralistic ethics in the imperative ‘clean the ears’, that overrides sonic experience.¹⁵⁸

A different field-recording author, Annea Lockwood (also Anna Lockwood) tunes to waterways, creating rhythmic aural perspectives on rivers such as the Hudson. Her approach treats water, self and sound as media:

We can’t listen to the water itself. We can only hear the impact of water on something. When I listen to the sounds of a shallow stream for a while, suddenly I feel as if I was caught in the water and listening to them from inside of the water. When I listen to the sounds of water dripping in quiet situation, my ears enjoy listening to the rhythmic patterns of its occurrence and fading into the back ground. The sounds of water make random rhythm,

‘listening effect’: ‘... Listening performers feel the ‘listening effect’ as they are performing for an audience. This is focal/global listening with the added perspective of a “witness” function.’ *Ibid.*, p. 16.

¹⁵⁵ ‘How opening our ears can open our minds: Hildegard Westerkamp’, Ideas, CBC Radio, 2 February 2017, <https://www.cbc.ca/radio/ideas/how-opening-our-ears-can-open-our-minds-hildegard-westerkamp-1.3962163>. See also Westerkamp, 2002.

¹⁵⁶ An environmental example of her numerous soundscape compositions using environmental sounds and her ecologically minded considerations is *Beneath the Forest Floor* from 1992, composed from sounds recorded in old-growth forests on the British Columbia Coast, Canada. It guides the listener through an immersive journey of acoustic and private, as well as historical environments. Similar sound-walks in the city of Lagos are organised by Emeka Ogboh; Akio Suzuki creates ‘oto date’ – ‘listen points’, with the logo of an ear – and footprints on public space’s ground for listening. Christina Kubisch has organised an electrical walk, transducing electromagnetic fields into minimal-techno sound.

¹⁵⁷ Hildegard Westerkamp, ‘Listening and soundmaking: A study of music-as-environment’, master’s thesis, Simon Fraser University, Vancouver, 1988, p. 71. Schaeffer and Schafer occupy two extremes on precisely this sonic spectrum: one strips context, the other emphasises it.

¹⁵⁸ An example of such limitations can be found in a remark by Westerkamp’s colleague R. Murray Schafer, who devised soundwalking in establishing the World Soundscape Project at Simon Fraser University during the late 1960s and early 1970s: ‘The Eskimos are such an astonishingly unmusical race that the composer really has to wring his material to make it musically presentable. There is a marked similarity between an Eskimo singing and Sir Winston Churchill clearing his throat.’ R. Murray Schafer, ‘On the Limits of Nationalism in Canadian Music’, *Tamarack Review* 18 (Winter 1961), pp. 71–78. This Western, colonial, racist musical logic of a

¹⁵³ ‘Quantum Listening leads you to notice that you are listening. Quantum Listening leads you to attention to a point – all or nothing focus which changes that point forever. Quantum Listening leads you to an all-embracing perspective of an ever-expanding field.’ – Pauline Oliveros, *Quantum Listening: From Practice to Theory (To Practice Practice)* (1999), available on author’s website, <https://s3.amazonaws.com/arena-attachments/736945/19af465bc3fcf3c8d-5249713cd586b28.pdf>.

¹⁵⁴ It entails learning to expand the perception of sounds to include the whole space-time continuum of sound, encountering vastness, paradoxes and complexities as much as possible. The answer to the question is an experiential process. But according to Oliveros, each listening practitioner, by the act of listening, affects the field, and the field affects the listener with a

representational soundscape composer resolutely depicts ‘landscape’ in contrast to Indigenous cosmologies, e.g., that consider song as being ‘for’ the land, rather than ‘about’ it. Dylan Robinson, a Xwélmexw writer of Stó:lō descent and associate professor and Canada Research Chair in Indigenous Arts at Queen’s University, Kingston ON, Canada, writes: ‘Nonhuman and intersubjective relations between song and land put into question those relationships between land and song in works including R. Murray Schafer’s *Music for Wilderness Lake* (1979) and Paul Walde’s *Requiem for a Glacier* (2013). These works that are ostensibly for lake and glacier do not in fact operate on the terms of reciprocal relationship wherein what is sounded is intended to have a material impact of sustenance for the lands, as gesture of thanks expressed to the lands. Despite the growing eco-musicological discourse and influence of new materialism and non-representational theory on artistic practice, these compositions often are still created for the benefit of the human subject rather than for nonhuman others, including the land.’ Dylan Robinson, *Hungry Listening, Resonant Theory for Indigenous Sound Studies* (Minneapolis: University of Minnesota, 2020), p. 123. The aim cannot be (anymore) ‘the great tuning of the world’. The challenge is a very different one: it is to *tune to the world*.

¹⁵⁹ Annea Lockwood, *A Sound Map of the Hudson River*, 1982.

¹⁶⁰ Salomé Voegelin, Sarah Hughes, Dawn Scarfe, Esther Venrooy & Heleen Van Haegenborgh and Steve Roden among many others create ‘listening cultures’ by composing ‘ways of listening’ with pieces that move at the very border of the perceptible, between the abstract and the documentary, e.g., Ernst Karel, Lucien Castaing-Taylor & Véréna Paravel’s *Leviathan* (2012) reinvents the relationship between anthropology, audio and video in the experimental Sensory Ethnography Lab at Harvard University. Their work takes a decentralising, non-anthropocentric approach, focusing on the fabrics of affective relations among organic elements, animals, technologies and physics.

delicate melody and subtle overtones which vary depending on

the physical contact surface, room reverberation, spatial size and

so on. In other words, the sounds of water reflect the character

of the space. And the space emerges through the sounds. In that

sense, we may listen to the scenery through the water rather than

listen to the water in the scenery.¹⁵⁹

There is a turn and reverb in perspectives: here there is no hunt

for the sound of a place, but the sounding reveals place. I became aware of such

twists during a Q&A after our presentation of *you are variations, version 01–02*,

at Montreux Jazz Festival. A young man in the audience asked if the encoded

music can be considered a sound environment, and if so, according to the *you*

are variations encoding system, what kind of environments are encoded in

other types of music, such as, perhaps, Bach.¹⁶⁰

The Peculiar Politics of Sound - *Becoming Whole*

The non-representational and non-narrative sonic journeys in *you*

are variations render nature as culture and culture as nature, while unearthing

an order of knowledge not based on identity, hierarchy and the universal, but

rather that is alive, participatory and experiential, enabling us to address urgent

contemporary concerns regarding the place of trees’ and humans’ ecologies on

Earth. With tuning comes ‘con-spiracy’, breathing together. With tuning comes

also ‘per-sonum’, that through which sound resonates, deepening our abilities

to re-gain the qualities of porosity, curiosity, attention and commitment, and to

experience them in communication, caring and mutual exchange: as per-son.¹⁶¹

With listening comes witnessing and responsibility. With listening comes also

the ability to speak. In practising *you are variations, version 01–02*, as noted in

the first case study, a voiceless boy started to speak.¹⁶²

Together with the composers, artists, musicians and all the trees

acknowledged in this chapter *you are variations* aims to participate in and

contribute to the sound that connects trees, selves and the world, bringing

about healing, joy and socio-ecological justice to all. With regard to its manifold

contexts, the research tries to remain open, receptive, always in a movement

towards. Perhaps its contextualisation cannot be achieved or concluded in a

meaningful sense at all. It is a work of soothing, mourning, witnessing, learning,

mediating, envisioning, nourishing and celebrating trees and each other – a

lifelong practice, as Pauline Oliveros used to say: ‘The more I listen the more I

learn to listen.’¹⁶³

This chapter concludes in linking back to Catherine Christer

Hennix’s statement about the art of becoming a medium for sound, and the

gifts this entails; this time in Oliveros’ words for ‘tuning oneself’:

None of us who compose and improvise music can claim credit

for inventing music. Music is a gift from the universe. Those of us

who can tune to this gift are fortunate indeed. We are interacting

¹⁶¹ Person (n.), c. 1200, *persoun*, ‘an individual, a human being’, from Old French *persone*, ‘human being, anyone, person’ (c. 1200, Modern French *personne*) and directly from Latin *persona*, ‘human being, person, personage; a part in a drama, assumed character’, originally ‘a mask, a false face’, such as those of wood or clay, covering the whole head, worn by the actors in later Roman theatre. OED offers the general nineteenth century explanation of persona as ‘related to’ Latin *personare*, ‘to sound through’ (i.e., the mask as something spoken through and perhaps amplifying the voice), ‘but the long o makes a difficulty’ Klein and Barnhart say it is possibly borrowed from Etruscan *phersu* ‘mask’. From mid-thirteenth century as ‘one of the persons of the Trinity’, a theological use in Church Latin of the classical word. Meaning ‘one’s physical being, the living body; external appearance’ are from the late fourteenth century. In grammar, ‘one of the relations which a subject may have to a verb’, from c. 1510. In legal use, ‘corporate body or corporation other than the state and having rights and duties before the law’, fifteenth century, short for person aggregate (c. 1400), person corporate (mid-fifteenth century), <https://giorgiomagnanensi.com/the-magical-forest/>.

¹⁶² See Case Study 01, p. 119.

¹⁶³ Oliveros, *Quantum Listening*, *op. cit.*, p. 5.

with a powerful resource and share with billions of musicians who have preceded us, who are simultaneous with us and who will succeed us. We can help others to learn to listen and participate by listening as a lifetime practice.

As musicians, we listen to make finer and finer distinctions in tone, sound and rhythm. It is the slightest nuances that accumulate and refine one's aesthetics. If we also listen to include more and more of what might seem to be background noise we perceive relationship to place.

¹⁶⁴ Also, '... This is true for our daily lives as well'. Pauline Oliveros, 'The Roots of the Moment: Interactive Music', *NewMus MusicNet: A Journal of New and Experimental Composition*, no. 1 (April 1995), p. 4, http://www.newmus.net/pdf/nmmn_01.pdf.

All sound ... brings information and connection.¹⁶⁴

Conclusion

A more sharing, open, connected way of knowing,
in which he who knows participates in the things he knows, is even reborn from them,
tries to speak their language, listens to their voices,
respects their habitat, lives the same evolutionary history, is enchanted by their narratives,
limits finally – through them and for them – his power and his politics ...
Dare I say they become human from it?
Yes.
– Michel Serres, *Biogea*, 2012

The initial research question considered over this ten-year-long project led to three interrelated propositions for inclusion: togetherness, wholeness and */wi/* instantiated in performance as a unique relationality between very different beings. The diverse organisms that meet through *you are variations* differentiate and evolve in their subjectivities, and also form an ensemble that emerges from intimate encounters among single, diverse and active participants. In this encounter arborescent (vertical, hierarchical) and rhizomatic (horizontal, autonomous) paradigms are discernible as two viewpoints within a single sphere, wholesomely integrating two legacies deeply rooted in Western thought. Difference – e.g., the difference between humans and trees – is not removed and is not the obstacle, but rather opens up a resonance chamber through which meeting and relation can take place. In conclusion, the mediating, compositional and performative work *you are variations, version 01–09*, on the water cycle through trees, gives way to a togetherness and wholeness, disclosed and indicated by a new personal pronoun */wi/* that addresses the ecopolitical challenges posed by the research.

The project started out with a quest for new attitudes: to give our encounters with trees and each other the power to trouble our thinking. The question ‘can we learn to listen to a tree?’ entailed a wide reconsideration of the issues in question, and in the process one question became many:

What does it do to refer to and attend to a ‘tree’?
How does it feel to ‘listen’?
What does ‘listening to’ imply, affect and mean?
How are we to ‘learn’, and more specifically,
how do ‘learning and listening’ relate to each other?
Are we ‘capable’? Are we ‘permitted’? Are we ‘authorised’?
And what does it mean and do to refer to, invoke and voice ‘we’?
Who feels called?

Yet another pertinently lurking question came up: ‘why aren’t we listening to trees?’ Politically it addresses the lack of a genuine sense of ‘we’ in our lives – an awareness of being amongst each other in a collective sense, as much as amongst me, you and the tree as integral beings. One of the research’s paradoxical findings is the insight that to foster a new collective relationship between me and the tree means to disclose the central emptiness, the hyphen – within myself – that separates me from the tree. The hiatus is within me, I risk myself in this cæsure.¹⁶⁵ In sounding the cliffs of this rupture, *you are variations* begins to sing, as a way of acknowledging and uttering the separation. Actually, *you are variations* are largos, their tune is mourning, lamenting. Surprisingly, it is precisely this grieving that enacts the sonic vessel that allows for connection, inclusion and union. The divide becomes the very aperture for another kin, an open bond: an inclusive ‘we’: /wi/ is proposed as new phoneme for this experience of communion.¹⁶⁶

/wi/ – this phonetic sign for a new personal plural pronoun, substitute on behalf of a name – does not encompass a further exclusion, but sonically enacts the vessel that allows for inclusion. Below I go into detail on the three interwoven tenets that have come out of this research: togetherness, wholeness and /wi/.

¹⁶⁵ Agamben, 2004, p. 92. As Agamben’s later work on paradigms demonstrates, a way to reconcile the caesura at the heart of the human being is to do away with dichotomous logics. Instead of relying upon a duality of the universal versus the particular, we can learn to respect the absolute singularity of each tree: ‘The world – insofar as it is absolutely, irreparably profane – is God.’ Agamben, 1998, p. 90.

¹⁶⁶ It directly connects to Donna J. Haraway’s ‘ethic of flourishing’ as developed in *When Species Meet*, 2008, p. 134.

Togetherness

Ecology of translation as methodology in *you are variations* acts as mediation in a complex process of communication between what we understand as one of the most diverse fields of knowledge: science and music. In *trans*-lating one frame of mind into the other it *re*-lates,¹⁶⁷ bearing difference(s) while carrying language(s) forth and back. It can be compared with weaving at the edges of the fraying fabric of our Western knowledge system, torn apart in the process of scientific diversification, technological specialisation and spiritual separation. In this sense, the project’s creation is the connecting fabric: a tissue, made of relation between diverse modes and forms of knowing, between different people and communities, between memories and thoughts that reside inside and outside, between you and me and the tree. It brings about connections and the invaluable experience of ‘togetherness’ as elemental outcome and necessary condition for a contemporary transdisciplinary ecological practice across a challenging range of urgencies.

The togetherness of *you are variations* works as a counterweight to the dominant investments in mere algorithmic, computational and technological solutions and brings about a rebound: listening to trees and each other lets togetherness emerge not despite of difference, but in difference: *you are variations* sounds the divide. Its music echoes from the ruptures and allows for acknowledgement, grief and convalescence from the nexus of separations. It is the paradoxical coming together we might experience giving birth and at funerals. The processually generated togetherness elicits the experience of wholeness.

¹⁶⁷ Trans-late, etymologically past participle from Latin *trans-ferre*, to bear, carry across; literally: borne along, carried across/to the other side
re-late, etymologically past participle from Latin *re-ferre*, to carry again: literally: born again, carried again.

Wholeness

As a transdisciplinary artistic practice across the bifurcation of science and arts *you are variations* reveals the rhizomatic and arborescent mindsets as two juxtaposed perspectives on a nexus of complexities that cannot be grasped by watching from the outside, but that can be met by participating in it. The research into concept and ocular perspectives proposes sonic practices – listening, tuning, composing, playing, collaborating and performing. These activities generate the condition and possibility for an event in which the trees’ complex system of relations – together with one’s own participation – becomes possible as an experience from the inside. It is this felt experience that leads to relating and taking part in a world that is neither vertical, nor horizontal, but spherical, in motion, continuously in the process of becoming whole together with us. In its entire trajectory *you are variations* leads to events of felt experience that eventuate embodied knowledge as a powerful form of an intimate ecopolitics that can bring integration to the many disastrous and harmful ruptures the human/non-human propagates, coinciding with interrelated forms of hierarchisation and subordination. *you are variations* brings acknowledgement, mourning and eventually recovery from what this intersectional matrix of separation cuts off, impedes, inhibits, prohibits, prevents, restrains, discourages, disables, and unables. Instead, what comes into reach through *you are variations* is the experience of wholeness.

/wi/

Experiencing wholeness coincides with the invention of a word that stands for the experience of being one with a tree – the becoming of each other and oneself – for the felt experience of an undivided togetherness instantiated by the performances. It is a quantitative and qualitative shift from *you* (are variations) – *I to you (I to tree)* – to */wi/*, the relation *I/you and the tree* or *I and you and the tree*. This ecopolitical */wi/* does not substitute for the English pronoun *we*. It does not proliferate a (new) group, an (alternative) association or a (novel) definition. It is neither noun nor pronoun. It is a verb that utters, and in doing so names the experience of open communion and communication: if */wi/* practise listening to the tree, */wi/* learn to hear the tree listening to */ʌs/*.

The ‘tree-*/wi/*’ is not enclosed within a boundary and cannot be surrounded. Even if we call it an environment, there are no insiders and outsiders, only openings, closings and ways through. The tree and me revolve around a greater collective that participates in our cycling: the soil, the atmosphere, the sun and the moon; our scientific, aesthetic and experimental forms of knowing; the technologies, algorithms and data they produce; the interpreter, modeller and composer who processes the data and their transcription into charts and scores; the scientists and voices and musicians and instruments that read and play the score; you who joined to listen to the permeating water. */wi/*, an ‘ecology of trees’, in short, is one of movement and stillness and water and cavity and sound and resonant relation among our many, diverse, enmeshed life cycles.

Listening as a method of tuning oneself turns out to be critically relational, an activity shared, also amongst more-than-humans. The tree, you and me, */wi/* are passages of living water. Learning to attune to its mysterious course is vital to partaking in the world.

‘What colour is the sacred? ...’

‘What do you mean by sacred? ...’

‘I mean the living.’¹⁶⁸

¹⁶⁸ My diary, 17 August 2015; with reference to Michael Taussig’s 2009 book of the same title.

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