Sonic Thinking: Epistemological Modellings of the Sonic in Audio Papers and Beyond

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Abstract

How is culture constituted sonically? In what ways are perception, thinking and epistemic practices as such predisposed by the sonic? These questions are being tackled in Sound Studies research but can also be experimentally elaborated in the form of organised sound itself. To (re)present and negotiate concepts and argumentations sonically is a yet rather marginal and unconventionalised form that bears a high potential for future research in Sound Studies and beyond – thereby following the recent impetus of a design turn within the humanities.

We developed this approach further at the Fluid Sounds conference in Copenhagen (2015) where we produced the audio paper Transducing the Bosavi Rainforest. Sonic Modes of Processing Culture on constitutive sonic structures in Berlin and Amager (Copenhagen) inspired by Steven Feld's work on the Kaluli people. This article discusses sonic epistemology and thinking as theoretical background of this approach of writing through sound and describes a concept of the audio paper format alongside the example produced in Copenhagen.

Keywords

sonic epistemology, dispositif, sonic thinking, audio paper, sound semiotics, topology

Introduction

While the audio paper as a format for academic publication is capable of rendering sound-related insights, the epistemic mode in which it does so remains underdeveloped: the sonic modality can convey knowledge and build arguments just as much as language or images. Nonetheless, it is not an established way of symbolic articulation and hermeneutic understanding, and experimentation and deliberation within the academic community are necessary to determine an adequate sonic means of expression. Apart from mere stylistic conventions, it has to be assessed how audio papers actualise their academic truth function, i.e. in their accepted relations to external sources, connectivity to academic and social discourses, and overall verifiability. Listening to and making sense of audio papers has to be practiced and learned as well. The success of this undertaking will show that audio papers can constitute a novel and insightful mode of writing through sound.

Heinrich von Kleist wrote a now famous essay with the self-explanatory title Über die allmähliche Verfertigung der Gedanken beim Reden (On the gradual production of thoughts whilst speaking) (Kleist 1997). The same might be claimed for any mode of expression. In this light, the production of audio papers as a sonic mode of academic research and discourse itself adds additional insight to sonically interested analyses and leads to a practice-driven way of sonic reasoning that can be self-reflexively studied as

well. Thus, in our dispositif analytical research on sonic thinking we endeavour to identify and assess the forms and efficacy of sonic epistemic models in analysis and synthesis, taking into account dispositive structures of the sonic such as technological media, historical discourses and bodily listening practices. Studying the constitutive relations between sound phenomena and culture in this way may transgress the realm of the auditory, e.g. in tracing sonic models like resonance or noise. Once such productive models are identified they might have the potential to be intentionally transposed to other contexts – to foster alternative ways of understanding, but also of reconfiguring or designing the world we live in.

Departing from an investigation of such sonic epistemic predispositions, i.e. sonic models out of cultural analyses, we are exploring how to align contemporary research and publication methods on sound. Other projects have argued for a more sonically inclined academic publication format, one that allows for the incorporation of actual sounds as well advancing multimodal arguments[1]. Nonetheless, the workings of sound semiotics and semantics in this context as well as sonic modelling still have to be explored and discussed extensively. For example, techniques of audio production like text-to-speech, stereo positioning and montage may be utilised to this end. Such audio papers may figure as manifest mobilisations of the epistemic potential of sound that take the next step from acknowledging our conditions of knowing to expanding this possibility space through new means and modes of meaning and knowledge production that differ from conventional logics of subject-object, form-content, or representation and deduction. Testing sonic models for generating academic audio papers or as epistemic tools in non-sounding fields of knowledge production are but two of many conceivable prospects of such contemporary sonic thinking (Gerloff/Schulze/Schwesinger 2016)[2].

Academic Audio Papers

Taking into account the interdependence of sonic experience, knowledge and media, it is ever more important to rethink the media in which research on sound is rendered (public). The limitations of the traditional academic textual or verbal formats are well-known and often contested in experiments with multimedia online journals, interactive exhibitions or lecture-performances. An investigation of the epistemic potentials of sound can therefore be extended into such practices as well, and participate in the development of new academic publication formats. The epistemic qualities of sound that are being uncovered throughout much of ongoing Sound Studies research can now be addressed and actively appropriated for academic discourse itself[3].
Why stop at the discovery and investigation of sonic epistemologies in historical or contemporary fields of practice and culture? Why not try to foster work in the form of academic sound practices as well? The deliberate development of a sonic format explicitly tied to the presentation of knowledge and insight and the advancement of academic arguments seems to be a promising goal. Consequently, trying to render research on sonic culture in sound will not just present the results of investigations a posteriori, but also deepen the insights concerning the respective sonic matters, complement customary research practices and transform abstract or verbal argumentations incorporating the object of research into the researcher's ›text‹. What is lacking is a process of explicit deliberation in the academic community on accepted

epistemic procedures, standards and requirements for such works.

We joined the conference and publication initiative Fluid Sounds that endeavoured to stimulate such a debate with a focus on a format for audio papers, combining site-specific explorations of Copenhagen's Amager island with the search for sound-based conference and publication formats[4]. Complementary to traditional textual formats its organisers Sanne Krogh Groth and Kristine Samson highlight the key feature of audio papers as follows:

> [T]he overall argument in the audio paper also has to be unfolded, discussed or framed through ›pure‹ sounds such as sound effects, music, found sounds, sound souvenirs, soundscape recordings or compositions, all composed into a sort of sound scenography. It is important, that the sounds do not only illustrate and frame the [spoken language] in the audio paper, but also [carry] information that supports or questions the narrated content in itself. (Krogh Groth & Samson 2015)

At this point it is necessary to highlight that the overall approach of the audio paper as we imagine it to be is not a documentary one. Rather, it should be understood as a heavily designed and manipulated expression or instantiation of our epistemic process, in a way similar to a classical text essay. Although sonic aspects of the sites we explored for our Fluid Sounds contribution Transducing the Bosavi Rainforest. Sonic Modes of Processing Culture plays a prominent role in our research process, the focus is more on investigating the subject cultures or fields in a multi-sensorial, comprehensive way, complementing a sound anthropological approach with the study of relevant discourses, material settings and other related sources as part of a Foucauldian dispositif analysis. In other cases, audio papers could of course be devised that draw solely on historical research or the sonic rendering of theoretical considerations. The primary research in our case is oriented towards the identification of epistemic aspects of sound in their interdependence with each other and with other elements of the dispositive setting. If a somewhat consistent pattern is discernable, this can be grasped as a sonic model that informs cultural meaning and practice within its context. Sonic structures or models of course carry information about their cultural contexts themselves, but can also function as epistemic tools, figures of thought or attention guides for an investigation of culture in general. In a kind of reverse writing or oscillation between the empirical research and our thought process we then again try to convey these models sonically. This means not just to present specific sounds but to stylise these audible forms in a somewhat exaggerated way to achieve the kind of conciseness necessary for them to be understood within this novel format of an audio paper. So while recorded soundscapes provide material for the audio paper it is not so much about representing their original cultural context through them, but about expressing our insights, considerations, hypotheses etc. sonically. Within audio papers devised as a rather expressive format, it is possible to reference empirical sources beyond the incorporation of recorded sounds, to generate a formal and argumentative structure through synthetic or sampled functional sounds and to include some verbal commentary as well. This process will be illustrated throughout the rest of the paper in relation to our Fluid Sounds project after a brief exposition of the non-sound dispositions of the sonic that shift into focus as part of a dispositif analysis, laying the ground for a subsequent

rendering as an audio paper.

Analysis: Non-Sound Dispositions of the Sonic

A dispositif analysis of the sonic facilitates a grasping of sound phenomena in their interdependency with contextual non-sound elements and their epistemic functioning's in different registers of culture. These relations of sound and its effects in other modalities unfold a network of meaning that can serve as a starting point for the shaping of sonic thinking in audio papers. Searching for the sources of sonic thinking directs attention to the various forms of knowledge production. On a discursive level, notions of sound can be analysed and applied in terms of their epistemic qualities of conceptualising relations between or statuses of things, see for instance productive metaphors like harmony and rhythm. Sonic thinking can also point towards our physiological and cognitive processing of sound as a perceived phenomenon. Furthermore, sound media has implemented meaningful signalling protocols that use qualities of sound to transmit, process or store contents or purposes. Especially in scientific epistemology, sound has been utilised to impart information on biological or physical systems following standardised regimes of signification, such as in auscultation, acoustics or phonetics. What links all these different forms of sonic meaning and knowledge production is their embeddedness in dispositive structures. According to Foucault's notion of the dispositif all expressions and manifestations that are produced within a certain epistemic ensemble of apparatuses, juridical orders, infrastructural configurations, discourses, bodily imaginations, etc. delineate the field of possible knowledge and thinking (Foucault 1978) and should be taken into account accordingly.

In the context of this paper, we deploy this kind of dispositif analysis of the sonic on a small scale to identify sonic epistemic models that might be utilised in audio papers. Sound in this way can be described as an operational part of cultural formations that is multi-faceted and always contingent within its dispositives. Consequently, there can be no ontological definition of sound, but an ever context-dependent blending of its physical properties with its cultural, technological or practical predispositions. This cultural-material understanding of sound and its relational actualisations can be addressed as the sonic (Wicke 2008, Ernst 2014). Thus, the sonic is not another word for sound, it pins down the specific conceptualisations of sound conditioned and shaped in discourses, media environments, corporeal listening habitus, etc. A sonic dispositif is formed around specific sound phenomena, driven and developed by sound. In each context a specific formation of the sonic may be identified which brings to the fore applicable differentiations of what counts as music, noise, signal or silence; technological regimes of sound processing that shape the sonic materially; or the specific cultural formatting of sound that allows for the existence of a repertoire of discernable sounds that can be heard – to give some examples of what the notion of the sonic might provide for such an analysis. Within such a methodological approach the non-sound predispositions of sound often provide form and context for the sonic events to make them effective and meaningful. Following transductions of the sonic through physical and technical properties, cultural semantics, bodily perceptions and affects, and renderings in text or speech, the important characteristics of specific historical models of the sonic can be determined[5]. When an acoustic phenomenon is transformed, for

instance as noise into notions of discourses, as interference into protocols of technical media or as threshold into judgments about bodily constitutions, it organises our relationship to the ›world‹ in a material and symbolic sense beyond listening understood in a narrow sense, and is thus related inextricably to human conceptual modelling (Gerloff/Schwesinger 2015). Accordingly, a set of sonic epistemic and generative models might be found and described to be effective as ways of thinking, approaching and shaping the world in many domains – beyond even those that sound.

By exploring the sonic conditions of knowledge and thought through such historical analyses, we strive to acknowledge our own epistemic boundaries in order to challenge and enhance semiotic regimes of current academic formats[6]. This endeavour can be seen as the continuation of the diverse turns in intellectual history that have turned our attention towards new or neglected factors of cultural meaning or knowledge production, be it language, images, affect or space. The acknowledgement and reflexion of the epistemic impact of these factors in some cases led to novel forms of academic representation and publication; see, for example, the development of new film formats in anthropological practice[7]. We are convinced that such a step from analysis to synthesis (or ›Gestaltung‹) can open up many possibilities to further sonic knowledge production and discourse. But since academic formats for sound are not established yet, it is beneficial to draw on pre-existing formats within and beyond the academic realm like soundscape compositions, radiophonic plays and features or existing functional sounds in order to use their design parameters to evoke and implement historically grounded sonic models in audio papers as propositional forms that may be meaningfully listened to and interpreted.

In our audio paper project at the Fluid Sounds conference we applied the dispositif analytical approach to investigate one basic sonic cultural model that respectively pinpoints the cultural status quo of central Berlin and Islands Brygge on Amager Island, Copenhagen. Taking Steven Feld's work on the Kaluli people of Papua New Guinea as a conceptual starting point for our audio paper, we conducted multi-sensorial field research, complementing this soundscape and music anthropology by consulting texts on urban planning and development as well as visual historical material, investigating traffic documentations, interviewing inhabitants, and analysing and engaging with the local media ecology. It is important to underline that the found and incorporated sonic models are not supposed to cover the ›whole‹ of any of these three contexts. Nevertheless, the concrete formal and sound design of these models within the resulting audio paper is the core challenge of this kind of writing through sound. Especially when it comes to its primary elements – the constitutive non-verbal sounds – the specific design decisions are far from being trivial and are always epistemic decisions as well.

The audio paper starts with an introduction to Steven Feld's exploration of the sonic figure of ›lift-up-over sounding‹. Feld identifies a specific organisational principle of Kaluli culture, which is more than a metaphor, it is a homologous structuring of rainforest soundscape perception, song and performance formats and even the Kaluli's social organisation (Feld 1992). We investigated this sonic figure and the epistemic structuring of its sonic and topological dimensions in respect to the specific ways overarching sonic models work in principle. We included it in the first part of the audio paper to invoke a sonically modelled relation between soundscape, music and social life

that we wanted to research for Berlin and Amager as well. We strove to compose the second part on Berlin similarly: instead of ›lift-up-over sounding‹ we found that the musical structure of build-up and drop in electronic dance music can be regarded as pervasive in Berlin's musical life as well as in its urban development and social life. Our investigation of Amager for the third section of the paper uncovered some parallels between this part of Copenhagen and the current state of Berlin. But what sounds were typical of the island? Rather than considering a musical figure as in the example of Berlin, we concentrated on the natural soundscape here. We identified waves as an important concrete aspect of this soundscape that also play a prominent role in the context of Amager's big radio stations as well as in the daily rhythms of commuter traffic. We then combined the ongoing build-up in Amager with the wave as a form to end up with the sonic model of a rising tide. The following section explores the ways in which we rendered these insights, modellings and materials sonically within the audio paper and our conceptual thoughts on the process.

Synthesis: Rendering Sonic Models in Audio Papers

Complementary to the methodological input from Feld's sound and music culture study that we tried to integrate with a sonic dispositif analysis in our audio paper, we had to develop a design strategy for rendering the found sonic models into a sounding academic argument. Thus, we started to devise audio papers that depart from conventional academic text essays or papers in order to transfer means and formats of reasoning into audio. Textual functions like indirect speech, dialogue, highlighting or punctuation play an important role when determining the meaning of written discourse. Similarly, auditory cues that don't seem to belong to the overall sound of the piece could be utilised to demarcate different parts or signal, for example, the appearance of a thesis. Where verbal speech is used in audio papers there are many possibilities to position and arrange different voices in order to correlate or juxtapose their statements. Considering quotations, italics, bold or underlining in an auditory realm not only calls for conventionalising equivalent means of expression but also for thinking about sonic means that convey aspects of their specific functions. The oral dimension of speech already enriches written language with its use and need for intonation, pronunciation, tempo, rhythm, dynamics, etc. But on the same side, such articulation narrows down a text to a certain meaning by stressing specific interpretations. The reconstruction of a writer's meaning is difficult to differentiate from the interpretation of the author of the audio paper when listening to a read quote, for example. Therefore, different frequency filters can be applied to interpretive verbalisations of written text as an additional layer in order to highlight text segments or key terms for the audio paper argumentation. In our Fluid Sounds project we employed Text-to-Speech (TTS) to verbalise quotations. Although TTS makes the listening comprehension more difficult we believe it has a strong value as a means of sound design in this context. It presents external context in an electronic voice, thereby conveying the secondary quality of the material by the level of mediation it embodies. In its artificiality and because the purpose of the technology is known, it also highlights the origin of the material in written text and emphasises the restraint from personal intonation and interpretation. The quotes are given in writing on the audio paper's webpage to remedy the disadvantage of TTS for listening. The semiotic relation of an audio paper's ›text‹ to its multi-faceted referenced sources itself is modelled by the use of such tools.

Audio example Lift-up-over sounding Bosavi[8]: Quote of Raymond Murray Schafer (1994[1977], p.40):

> [W]e should draw attention to the fact that many of the signals communicated among animals – those of hunting, warning, fright, anger or mating – often correspond very closely in duration, intensity and inflection to many human expletives.]

AudioPlayer

Expanding the work on audio papers in this vein, a toolbox of sound design – an auditory rhetoric or grammar – may emerge that helps establish this format in the academic discourse. Compared with the audio design of speech, structuring non-verbal argumentation can be even more challenging. In the example above, Feld's arrangement of field recordings should not be regarded as an illustration of his written argumentation. Instead, one can productively analyse why the sound passages that he published so convincingly support his theory – besides the fact that the aesthetics of field recordings confirm some kind of authenticity or evidential quality. Treating the recordings as artefacts, i.e. as records that embody a certain spatial and temporal logic that can be worked with for compositional reasons, three organisational principles seem to be relevant for a lift-up-over sounding impression. First, a foreground is clearly distinguishable from a background. After giving the impression of approaching a village, human communication and work activities are centred and singled out as staged performances for which the sounds of the forest still act as a recognisable but distant scenery. This division is replicated in the background as its sounds do not completely smooth into a ›monochrome‹ noise floor. Fairly clearly objectified utterances of its animal inhabitants speak out towards the foreground as mediating components and signifiers of possible connection. Second, the rhythmic patterning of the subsequent stomping reveals the synchronisation model that works on discernable pulses to structure the spatial order also temporally, namely in phases of foreground impulses and phases of background impulses. This underlines the isolation of certain background signals while keeping some distance to them. Third, this creation of shared but apart space-time is emphasised by the following melodic harmonising in which the performing person in the front tunes in with appropriate tonal whistles. In fact, what Feld is providing the listener with is the ongoing process of synchronising and de-synchronising of audio signal sequences on various levels in order to present the sonic model he discovered. In the successful moments of multi-level synchronisation the emergence of this pattern can be felt affectively.

When specific sound events fall into place in what appears to be a ›natural‹ composition, their new contextual framing changes their sourcing of meaning and system of reference from an ecologic to a figurative order. In this case a sonic cultural model can highlight structural or relational aspects of its elements and as a whole while representing the sound phenomena themselves in a detail that would be difficult to transpose into written text. Semiotics, building on Charles Saunders Peirce, has described this as a shift from an indexical sign function to an iconic one (Peirce 1955,

Sebeok 1994). Listening to non-verbal sounds usually works indexically, i.e. they (re)present their original empirical setting directly. In this way sounds direct our attention to their emitters. Providing more information on their emitters, for example on their colour, shape or biography, is, however, difficult to accomplish with this semiotic function. Words, on the other hand, are able to reference and relate diverse things and concepts. In this sense, a sonic logic cannot be as clear and precise in communicating various contents, whether in its representational or in its argumentative aspects. Nevertheless, sonic references and representations are far from being unusual, as sounds cannot be separated from their situational, societal, discursive, medial, juridical, etc. connotations. Utilising them can trigger understandings of outlined referential arguments by invoking meaningful contextualisations and associations. Referring to Peirce, this would account for the arbitrary symbolic function of signs. His third category, the iconic relation, might be exactly the mediating relation that facilitates the various connections between different realms, the semiotic conception that is complementary to the intermediary concept of the sonic. Turning once more to the example above, it becomes obvious that the emerging order of the sonic cultural model of the Kaluli draws upon indexical and symbolic sign functions, the former by directing attention through sound signals, the latter by culturally loaded referencing to structuring categories and concepts beyond a human-animal divide. The link between both functions is established through the emergence of a spatiotemporal event that is organised and structured by the sonic modelling of a specific form of synchronisation, relation and articulation of individuals and their environments. In this sense, sonic cultural or epistemic models might operate relying on Peirce's concept of iconicity as it establishes formal relations of similarity that become in itself meaningful.

Making use of this line of thought we strove to develop and present a sonic cultural model of Berlin in the form of a build-up. Using a street scene as our departure point we introduced the sounds of a nearby construction site. Apart from representing itself, the construction site in the context of Berlin invites the listener to comprehend this sound on a more general level: It quite literally alludes to the fact that there is currently much construction work happening in the city, and in another layer invokes the associated social debates concerning gentrification. Using spoken language as the narrating voice we then also introduced the musical concept of the build-up and subsequently inserted the dimension of musical culture of public urban life in a subtle way as well. In our analysis the focus lies specifically in discerning relations between the realms of soundscape, music and social life. Accordingly, the field recordings were complemented with other samples and morphed into a musical build-up reminiscent of that used in electronic dance music. This was not an arbitrary choice, since this music is the most prominent kind of popular music in Berlin and an important part of its image as a thriving city that many people and companies like to be part of. Thus, we utilised an iconic relation between the escalation of construction activity, people moving into town and the rising of suspense in the electronic music club to transform this semiotic function into a symbolic one: to make an argument on the contemporary cultural situation in Berlin on the basis of a sonic model.

Audio example: Build Up Berlin

Audio Player

Soundwise, the sonic model of a build-up draws first and foremost on spatial properties of sound, such as frequency cancellation due to different wavelength propagation, or loudness felt due to distance and reverberance characteristics. Dynamic filtering and terraced dynamics can generate the effect of an ever increasing or approaching intensity of sound. With the advent of disco in the 70s the correspondence of basic spatial orders of above/below and left/right – or more dynamic vectors surpassing these orientations – with ›high‹ and ›low‹ frequencies of tones could finally be operationalised for the management of affective excess on the dance floor. At that time the long tradition of spatially orienting and metaphorically interpreting frequency differences had been effectively incorporated into the media ecologies of clubs that layered frequency ranges vertically for the first time. This new ensemble of listening technologies (maxi-singles & sound systems) has re-organised hearing and facilitated specific cultivations and technisations of perception, thereby working their way into the very corporeality of the listeners[9]. This development could be regarded as the starting point of the cultural semanticisation of the build-up as a topological figure. Habitualising non-cochlear listening practices that correlated with this development meant to bodily experience this spatial articulation as well. The cultural connotation of affective excess depends on a form of distributed agency that emerges through a dispositive entanglement of all its human and nonhuman elements (Kassabian 2013, Henriques 2011). These elements, bound together by this model, are therefore subject to a process of (in)formation that can't be traced back to any singular origin or driving force. It is impossible to stop once set into motion, leading to an inevitable implosion, which is used in our example to organise sounds of urban development in accordance with musical parameters to evoke the same topologic of excess in the context of gentrification. In this way non-sounding cultural semantics can be addressed by utilising spatial and affective characteristics of sound as music.

Complementarily, positioning sounds or speech horizontally along the stereo panorama can be used to statically oppose or associate, or dynamically relate events or arguments. It may also refer to our reading direction from left to right to signal relations of progress or consequence. In the last part of our audio paper concerning the island of Amager, Copenhagen, we appropriated this topological approach in a less musical and affective but more geographical and gestural sense. Investigating this area, we focused on the southern part of a quarter called Islands Brygge which is being redeveloped as a residential coastal neighbourhood. It stretches out from north to south in a rather long strip and is complemented by a vast public recreational area, the Faelled. As mentioned above, the various characteristics of this quarter led us to introduce the rising tide as a hypothetical sonic model for the ongoing developments there. In a structural homology to the local geography we mapped the construction-site sounds of urban development on the left (Western) side of the stereo mix and the bushes-and-woods sounds of the Faelled on the right (Eastern) side. Beginning with the recording process, we mimicked the waveform by rotating the binaural microphones vertically to achieve a similar kind of spatial impression when listening. Sonifying the increasing activities in this area we

then successively added sonic events, steering them across the imagined territory. We used panning to merge the previously distinct parts of the residential strip and the recreational park and tried to create the impression of a rising tide by using the site-specific field recordings. When taking this topology into consideration while listening, much more sense can be made out of the piece than just by identifying specific sound sources like nature sounds, the waterfront or the talk in a local bar.

Audio example: Rising Tide Amager

Audio Player

These dimensions of the semiotic concept, the implemented topology or means like TTS for making references to other kinds of sources are but three of several possible registers of meaning-making that could be developed for audio papers. Much the same as the spatial order is linked with semantics, the temporal order can be utilised to establish a distinct structure for an argument as well. The temporal succession in the piece can for example be correlated with the order of historical time or simply convey a process of development in telling a story. Experimenting with clearly demarcated parts similar to rhetoric or musical forms can help to clarify whether the respective sonic material is meant more to present content, make an abstract point, lead over to another area or serve as a summary. Through rhetorically denominated parts the function of the presented sounds and their relation with each other may be understood better. Another way to juggle with argumentative relations of concepts could be to further differentiate the topological semantics with a stronger use of foreground/background relations, layering of sounds in different distances and making use of auditory masking for comparison. Gender aspects as well as human-machine-relations could be tackled by manipulating the tone of incorporated voices. The voice could serve in general as the platform for modelling specific kinds of subjectivities. Needless to say, the verbal and non-verbal sonic material and the paper's paratexts don't necessarily have to work together to support their respective argument as in our audio paper, but can also contrast, contradict or complement each other to constitute the paper's sense. While Transducing the Bosavi Rainforest might still sound pretty similar to well-known soundscape compositions, in our upcoming work we want to more strongly develop the argumentative dimension of audio papers versus their representational mode.

Conclusions

To sum up, what kinds of epistemic logic or propositional form are put forward in audio papers as we evoked them here? Although language might be incorporated, the logic on the sonic level itself doesn't work like human language neither in its representational nor in its argumentative aspects, because there isn't a fixed sonic vocabulary or grammar for this function. Nonetheless, through the sonic material details of sound phenomena can be conveyed that would be hard to describe in writing. As words reference things or concepts, the same can be reached by sonic references that invoke imaginations of their sources as in the simple case of primarily indexical sounds – remember the construction work in Berlin. The musical figure of build-up and drop on

the other hand works primarily metaphorically and tells the listener that we attest this ongoing build-up and raise the question of a following drop concerning Berlin's urban culture. This proposition could only be made because the musical origin of this figure provides it with a specific meaning. The fundamental dimensions of space and time bring along their own structures of sense and meaning. A temporal order within the piece puts sonic events into relation and suggests an analogous temporality in the referenced context. This can also be thought of rhetorically: introducing an argument, complementing it with a counter-argument and then coming up with a synthesis. Similarly, spatial configurations in sound design utilise established semantics of, for example, high and low or foreground and background. Terming frequencies high and low is already an effect of this spatial logic. Relations of elements of an argumentation can accordingly be modelled through their positioning in a topological order. Argument and counter-argument could for instance be arranged on opposing sides of the stereo spectrum.

The argumentative logic of audio papers thus emerges through structural, figurative and propositional sonic forms that can manifest relations specifically and precisely. It becomes clear that sonic figures and models facilitate the production of meaning in audio papers by their mediation between sound and non-sound dispositions of the sonic, different realms of culture and fields of knowledge. Audio papers therefore not only depend on a thorough analysis of the research object or field, but also draw on the repertoire of other studies of epistemic qualities and functionings of sound as well as practical knowledges of sound design that are densified to build its form and content. The aspects of analysis, modelling and synthesis that we unfolded here are accordingly – and bearing Kleist in mind – inextricably interwoven in practice instead of being conducted consecutively. They don't have to be related to the same object: It is not necessary, for example, for a sonic pattern found in analysis to be rendered audible in the audio paper. Instead, a model derived from a different analysis might be used as an epistemic tool itself, contrasting or primarily informing the analysis and providing a different perspective on the subject matter. Of course producing and listening to audio papers has to be practised and habitualised for such a novel communicational, representational and epistemic format in order to function properly. Misinterpretations and irritations should be seen as productive factors in this process rather than failures. If such a development successfully takes place, audio papers can constitute a novel and productive mode of writing through sound.

Footnotes

1. These projects include the original context of our audio paper discussed here, the Fluid Sounds conference, as well as the online collection Provoke! Digital Sound Studies or some works on the digital publishing platform Scalar (Schäffner 2010)
2. This project relates to the recent design turn in the humanities, similarly striving for an inclusion of analytical and reflexive research in design processes on a social and cultural level, understood in the broad sense of ›Gestaltung‹
3. Veit Erlmann's study Reason and Resonance conducts such historical research on sonic thought and discourses in an exemplary fashion (Erlmann 2010)
4. Notably, the conference was not only concerned with audio papers as publication formats but also with presentation formats and site-specific installations
5. In a similar vein, Jonathan Sterne's study of the MP3 format (Sterne 2012b) and Shintaro Miyazaki's work on algorhythmics (Miyazaki 2013) investigate the interrelation of technology, sound and culture
6. As Erich Hörl points out in relation to Gilbert Simondon's work, we are currently undergoing a shift in our regime of meaning, knowledge and sense towards a technological and ecological conditioning: »It originates the new sense-culture of technology – with multiple, transversal agencies beyond the centralization and monopolization of the working-meaning-perceiving human subject (Hörl 2013, p.125)
7. An early example would be the films of Trinh T. Minh-ha. Currently, the works of Lucien Castaing-Taylor and Véréna Paravel expand this tradition [↵] This audio example contains excerpts from the following two tracks: "Fo:Fo: and Miseme sing at their sago place" by Fo:fo:, Miseme & "Voices of the forest: a village soundscape" by Bosavi Village; from 'Bosavi: Rainforest Music from Papua New Guinea,' Smithsonian Folkways Recordings, SFW40487_204, provided courtesy of Smithsonian Folkways Recordings. © 2001. Used by permission
8. For example, the famous Levan Horn and other devices targeting bass and sub-bass frequencies invented in the 70s were positioned on ground level and expanded the range of the sonic into the infrasonic area; tweeters were hung high beneath the ceiling (Papenburg 2012)

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Bio

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