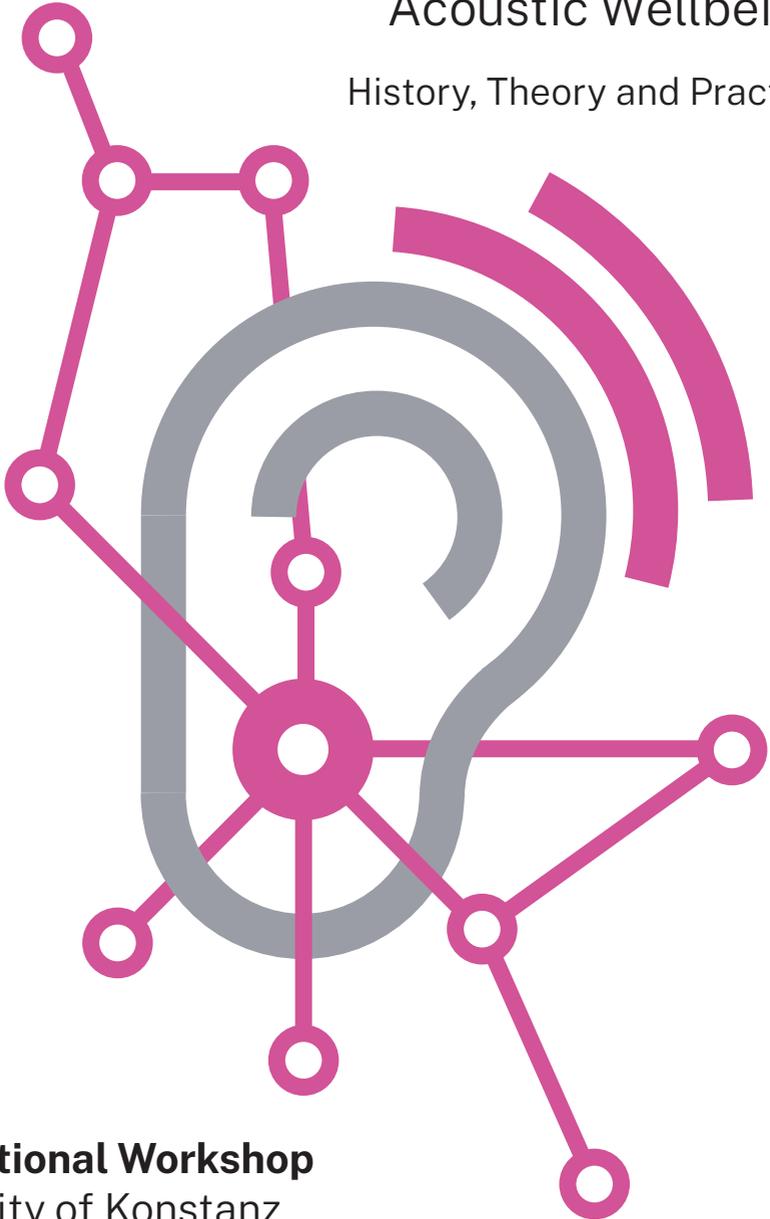


Smart Hearing

– Enabling Technologies of
Acoustic Wellbeing

History, Theory and Practice



International Workshop
University of Konstanz
and University of Exeter

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Hearing, Consequences of Hearing Impairment and Benefits of Hearing Aids



Stig Arlinger, Linköping University, Linköping, Sweden

Hearing impairment affects human interaction with other humans as well as with the acoustic environment as a whole. The most obvious form of impairment is loss of auditory sensitivity, but in addition also qualitative changes in the auditory organ occur, making the listener more vulnerable to adverse listening situations. For many people affected, hearing impairment causes reduced social activity and isolation. Among the elderly also other age-related problems occur, e.g. reduced visual acuity, balance problems and reduced motoric control. The decline in cognitive functions that is correlated with increasing age has been in focus with regard to its causes and whether age-related hearing loss is a causative factor – the issue is still not resolved.

The 1990-ies presented radical changes in terms of technical aids for hearing impaired people: digital signal processing in hearing aids and multichannel cochlear implants. Although no technical device can restore normal hearing, still the benefit for large groups of hearing-impaired people are obvious.

Stig Arlinger has a M.Sc. in electrical engineering, KTH, Stockholm and in Biomedical Engineering, University of Pennsylvania. He is Dr. Med.Sc. Linköping University and professor in technical audiology, Linköping University (now emeritus). Research interests are diagnostic audiology, hearing aids, cognitive hearing science and noise-induced hearing loss. Active in international standardisation regarding hearing aids, audiometry and hearing protection. Former chief editor of Scandinavian Audiology and International Journal of Audiology.



Enhanced Hearing – Signal Processing and Optimization of Hearing Aid Systems



Rainer Linus Beck, Cochlear Implant Centrum Freiburg – ICF, Germany

Hearing aids are no more restricted to ameliorate the hearing loss of the individual patient by amplification or electrical stimulation. Using ingenious microphone technology and powerful signal processing, hearing aids may perform better in certain situations than unequipped ears. Integration into modern communication infrastructure provides even more benefit compared to real time translation and personal assistants.

This will provide an overview of the state of the art in the domains of signal detection and processing in hearing aids and associated technology. It will highlight where assisted hearing may be more helpful than biological hearing and promote discussion about future developments and where the perception of the individual may be altered thusly.

Rainer Beck works at the Freiburg University Hospital as the head of the department for pedaudiology, speech/language development and voice disorders. He is deputy head of the Implant Center Freiburg. Focus points for research are cochlear implants. In his free time, he enjoys the mountains as well as sailing and is involved in the project „Musical Therapy“.



Producing the Unquiet Quiet: A History of White Noise and Technologies of Sound Conditioning

Joeri Bruyninckx, Maastricht University, Netherlands

Smart hearing encapsulates a promise of active noise control and focused listening. This paper historicizes that promise by examining the historical conditions, prospects and practices that surrounded the emergence of white noise and other sound conditioning technologies. Since the early 1900s, noise has been presented as an irritant that affects listeners' physical and mental wellbeing — an acute societal problem to be abated by scientific, technological and political means. Yet in the decades after WWII, a redefinition of noise in informational terms prompted new military and consumer applications: promising listeners' focus and wellbeing, sound conditioning redefined auditory environments by masking noise *with* noise. Focusing in particular on the US office environment — since long a key site for developing attention-preserving technologies — around 1970, this paper examines the tensions between these two understandings of noise. As an inverted history of noise control, it traces focused listening as a product of extensive socio-technical networks.

Joeri Bruyninckx is assistant professor in Science and Technology Studies at Maastricht University (NL). His research focuses on the relations between technology, bodily experience and scientific knowledge. Previously, Joeri was research scholar at the Max Planck Institute for the History of Science in Berlin and visiting researcher at M.I.T. and Cornell University. He has published on listening and knowledge practices in twentieth-century field biology and contemporary experimental sciences, and is the author of *Listening in the Field. Recording and the Science of Birdsong* (MIT Press, 2018). His ongoing project focuses on embodiment and technology in the information age.



Reframing Music, Imagery and Emotion-Neural Dynamics of Shared Hearing in a Healing Setting

Jorg Fachner, Anglia Ruskin University, Cambridge, UK

An important aspect of music in healing environments is to reframe the patient's focus of attention to encourage a positive self-perception, discover new vistas and potentials. To induce state change and altering cognitive frames of reference, intense emotion and imagination processes are evoked during music listening or making. In Guided Imagery and Music (GIM) a patient in deep relaxation listens to selected music in order to elicit imagery for psychotherapeutic purposes. While listening the patient speaks with the therapist about emerging imagery. Musical acoustics and corresponding internal sound staging contribute to an 'emotional scenic background' for imagery. Recently we were utilising EEG hyperscanning to study the shared emotional processing of the imagery related to music. Two particular moments of interest in the therapy, the corresponding temporal neural dynamic of frontal processing, changes in visual (occipital) cortex and cross-correlations of frontal inter-brain processing will be discussed.

References

Dr. Fachner, Professor for Music, Health and the Brain at Anglia Ruskin University in Cambridge, UK, is interested in translational issues of interdisciplinary research topics between medicine, humanities and music sciences. Studying MT processes, brain responses and treatment of depression, as well as consciousness states and time perception, his scientific output comprises over 100 publications in journals and books across disciplines. He is currently running two social neuroscience research projects (UK Music Therapy Charity; Austria: CDG) on dyadic interaction measuring neurodynamic 'Moments of Interest' in music therapeutic processes with older people, dementia and stroke patients.

Testing Hearing with Speech

Mara Mills, NYU Steinhardt, New York, USA

This talk examines the use of speech to test hearing. In the interwar period, researchers at AT&T conducted an enormous amount of research — experimental and demographic — on the “fundamentals” and ranges of human speech and hearing. This research, which was part of a broader quality control program for the expanding telephone system, included tests on topics such as minimum and maximum frequency thresholds, masking, and binaural sound perception. Telephone engineers were particularly interested in establishing a measure for “useful” or “serviceable” hearing, which they identified with speech perception. To this end, they developed a number of tools to test hearing with speech: phonetically balanced word lists, syllabic testing lists, test sentences, articulation indices, and phonographic speech audiometry recordings. These not only became the standard for testing electroacoustic equipment, they were also adopted by the medical field of speech audiometry; I will consider the lasting consequences of the quality control paradigm in the latter field. In the 1940s, moreover, AT&T engineers helped establish the “percents of usable hearing” for insurance companies and the American Medical Association, embedding telephonic values within the national standards for normal hearing.

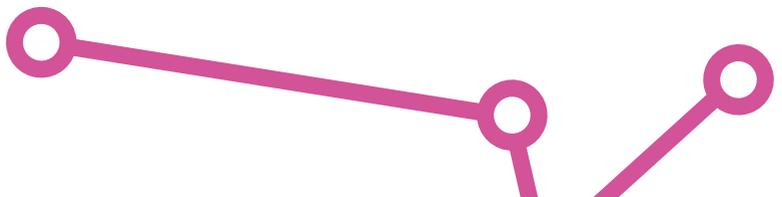
Mara Mills is an Associate Professor of Media, Culture, and Communication at New York University who works at the intersection of disability studies and media studies. Her book *On the Phone: Hearing Loss and Communication Engineering* (forthcoming from Duke University Press) argues for the significance of phonetics and deaf education to the emergence of “communication engineering” in early twentieth-century telephony. This concept and set of practices later gave rise to information theory, digital coding, and cybernetics — along with new electroacoustic tools and a revised understanding of human speech and hearing. Mills is currently working on the history of optical character recognition and, with Jonathan Sterne, she is co-authoring a book titled *Tuning Time: Histories of Sound and Speed*. Mills is a founding editor of the journal *Catalyst: Feminism, Theory, Technoscience* and a recent member of the executive council (2016-2018) of the Society for the History of Technology. With Faye Ginsburg, she co-founded and co-directs the NYU Center for Disability Studies.

Smart Hearing? The Relationship of Algorithms and Acoustic Wellbeing

Miyazaki Shintaro, Critical Media Lab Basel, Academy of Art and Design FHNW, Switzerland

My contribution will discuss the relationship between acoustic wellbeing and algorithms from the perspective of socio-politically informed media critique (Foucault, Butler, Wark, Chun). For doing that it very briefly inquires the media history of measuring wellbeing as such, then looks specifically firstly into cases where algorithms are used to measure acoustic wellbeing, secondly into cases where algorithms operate in real-time signal processing to improve acoustic wellbeing of hearing impaired persons (cochlear implants and/or hearing aids). For each of these fields I will not only try to reflect upon the definition of wellbeing and its relation to the environment, but also look at possible negative impacts of “smartness”. Finally, I will argue for the general importance of critical media studies.

Shintaro Miyazaki is a Senior Researcher at the Critical Media Lab Basel, Academy of Art and Design FHNW. He studied media studies, philosophy, and musicology in Basel and Berlin where in 2012 he received a PhD in media studies (about the history of digital technologies focusing on algorithms and their rhythms by coining the term algorithymics). Since about six years he is on an extended field trip in humanities-driven, experimental media design research and interested in how we can generate moments of criticality which could emancipate us from our self-imposed ignorance of the algorithmic infrastructures we are captured by.



Pleasure and Pain with Amplified Sound. A Sound and Music History of Loudspeaker Systems, Germany ca. 1930

Jens Gerrit Papenburg, Rheinische Friedrich-Wilhelms-Universität Bonn, Germany

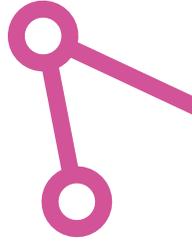
In the 1920s and 1930s the German company Siemens & Halske and later Telefunken produced complex public address systems. Such systems were installed in various spaces and environments — reaching from fairgrounds to factory sites, from opera houses to sport stadiums, from railroad stations to stock exchanges. They produced new sound volumes, combined music and sound history and enabled novel hearing practices. In my presentation I analyze the sound of these systems and the listening practices correlating with it following three threads: (1.) How did these systems become an integral part of music, listening and even fascistic aesthetic pleasure? (2.) To what extent did these systems correlate with discourses about hearing impairment and acoustic stress through loud, voluminous and ubiquitous sound? (3.) How did hearing become organized as a vibrational practice of war invalids relating to these systems?

Jens Gerrit Papenburg is a Professor for Musicology/Sound Studies at Rheinische Friedrich-Wilhelms-Universität Bonn. He is the co-editor of *Sound as Popular Culture. A Research Companion* (MIT Press 2016) and member of the editorial board of “*Sound Studies. An Interdisciplinary Journal*” (Routledge). He was visiting professor at Humboldt-Universität zu Berlin, Leuphana Universität Lüneburg and Heinrich-Heine-Universität Düsseldorf. His current projects include the monograph “*Listening Devices. A Sound and Music History of Records, Jukeboxes, Sound System*” (to be published by Bloomsbury).



Better Hearing for All - Smart Solutions for the Clinical, Subclinical and Normal-Hearing Population

Jan Rennies, Fraunhofer IDMT, Hearing, Speech and Audio Technology, and Cluster of Excellence Hearing4all, Oldenburg, Germany



Sound perception is a highly individual phenomenon that depends on many factors (e.g., noise, reverberation, individual hearing loss or preferences). In particular, speech communication can be impaired in many situations. While medical hearing aids can be beneficial in many situations for people with hearing loss, they cannot solve communication problems for people with audiological normal hearing or the so-called subclinical population with mild, untreated hearing loss. In other words, many people beyond the typical clinical population could potentially benefit from hearing support technologies if they were integrated in application-specific, non-medical devices. Examples include telephone speech in environments with ambient noise or distracting colleagues (like callcenters), too ambitiously mixed TV dialog, or hearing protection devices preventing users from communicating with their peers. This contribution presents recent research and development of personalized sound processing schemes, which combine fully self-administered fitting concepts and innovative user interfaces and algorithms.

Dr. Jan Rennies-Hochmuth studied Engineering Physics in Oldenburg and Lyngby, Denmark. After receiving his M.Sc. in 2008, he joined the project group Hearing, Speech and Audio Technology of Fraunhofer IDMT in Oldenburg, where he is now head of the group “Personal Hearing Systems” since 2012. In 2013, he received his doctoral degree for his research on speech and loudness perception. His research interests include algorithms and models for predicting and improving speech perception in complex listening scenarios, psychoacoustics and assistive hearing devices.

Technologies of Silence. On their Archaeology and their Aesthetics

Jens Schröter, Rheinische Friedrich-Wilhelms-Universität Bonn, Germany

Silence is not just the passive absence of sound. Silence has to be actively produced and constructed. One pertinent example is of course the blocking of outdoor sound by special windows. Another would be the use of earplugs. These technologies were developed because the omnipresence of noise is often disturbing, even causing sicknesses. Producing silence can therefore be a form of sonic wellbeing. My talk will especially address noise-cancelling-headphones.

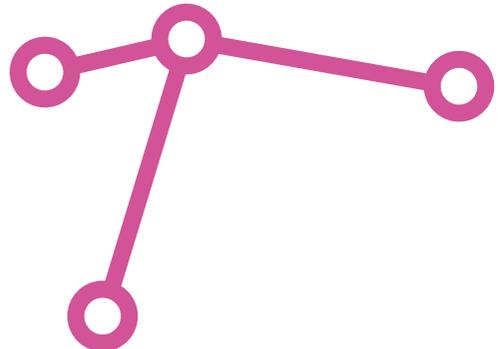
Jens Schröter, Prof. Dr., is Chair for Media Studies at the University of Bonn since 2015 and Speaker of the Research Project “Society after Money – A Simulation” (VW foundation) since 2018. He was Professor for Multimedial Systems at the University of Siegen 2008-2015 and headed the Graduate School “Locating Media” at the University of Siegen from 2008-2012. He co-directed the DFG-research project “TV Series as Reflection and Projection of Change” (2010-2014) and was speaker of the Research Project “Society after Money – A Dialogue” (VW foundation, 2016-2018). He was a Senior Fellow at the research group „Media Cultures of Computer Simulation“ (2014/2015), at IFK Vienna (2017) and IKKM Weimar (2018). Recent publications: (together with „Project Society after Money“) *Postmonetär denken*, Wiesbaden: Springer 2018; (together with „Project Society after Money“): *Society after Money. A Dialogue*, London/New York: Bloomsbury 2019; *Medien und Ökonomie*, Wiesbaden: Springer 2019.

Emerging Ways of Hearing in the Context of Re-Produced Speech

Miklas Schulz, University of Duisburg-Essen, Germany

Given the fact that the structures of sensory perception can't be perceived by themselves, this paper engages in the practices of appropriating sensory activities by drawing on speech mediated hearing of people with visual disabilities. Comparing qualitative interviews with auto-ethnographic data, Miklas Schulz stresses the differences as they become apparent in the way we interpret our own sensory practices. In this process, what we perceive is the partial result of how perception is mediated by specific sets of practices and media technologies. This perspective contributes to the understanding of processes of normalization and the limits of our sensory capabilities.

Miklas Schulz, Dr. phil., is professor (Vertretungsprofessur) of Inclusive Pedagogy and Diversity at the University of Duisburg-Essen. He holds a PhD in sociology, media studies and communication science. His main research areas are: the body, senses, media, cultural sociology, disability studies, and qualitative methods. In 2018, he published the monograph *Hören als Praxis. Sinnliche Wahrnehmungsweisen technisch (re-)produzierter Sprache*.



Measuring Listening Effort: An Attempt to Quantify Mental Exertion

Jürgen Tchorz, Lübeck University of Applied Sciences, Germany

Many every-day listening situations are characterized by acoustic conditions which allow for almost full speech intelligibility, but which require varying degrees of mental effort to fulfill this task, depending on background noise or reverberation. Thus, traditional speech-in-noise tests are not suitable to measure listening effort. In addition, people with hearing loss are more challenged in these situations and are likely to feel exhausted after a shorter period of time, compared to people without hearing loss. In the last years, there has been fast growing interest to investigate listening effort, and to develop methods to measure it. The talk gives an overview about psychophysical and physiological ways to quantify listening effort, the correlations between these methods, and the effects of hearing loss and hearing aids.

Jürgen Tchorz studied physics in Oldenburg (Germany) and Galway (Ireland). After his PhD on auditory-based sound signal processing he worked for a hearing aid manufacturer in Switzerland. Since 2005, he is professor at Lübeck University of Applied Sciences in Germany, where he teaches psychoacoustics, technical acoustics and hearing aid technology in the Audiology programs (B.Sc. and M.Sc.). His current research interest focuses on acoustic scene classification in humans and computers. He is involved in the „JuniorCampus“ project in his university which aims at sparking childrens interest in science, technology and engineering.

Techniques versus Technologies. Smart Hearing around 1900

Viktoria Tkaczyk, Max Planck Institute for the History of Science, Berlin, Humboldt-University Berlin, Germany

Around 1900, the question of what was smarter, newly invented technologies or techniques of mental power, was not yet decided. A century before the era of ‘smart technology’, hearing could be perfected by assistive devices, or by training the human ear and brain, or both. In my talk, I explore how the emergence of new acoustic instruments – hearing aids, recording technologies, measuring devices – related to novel techniques of listening in this period. I focus particularly on the Austrian otologist Viktor Urbantschitsch, with his treatment of residual hearing, and on the German tone psychologist Otto Abraham, with his proposed methods of acquiring perfect pitch. Both these scholars prompted heated debates about the dividing line between technologies and techniques, hearing and listening, ear and brain, and body and mind.

Viktoria Tkaczyk heads the Research Group “Epistemes of Modern Acoustics” at the Max Planck Institute for the History of Science, Berlin, and is full professor at the musicology and media studies department of the Humboldt University, Berlin. Her first book, *Himmels-Falten: Zur Theatralität des Fliegens in der Frühen Neuzeit* (Munich: Fink), won the Ernst Reuter Dissertation Prize in 2008 and the Book Award of the Amsterdam School of Cultural Analysis in 2012. Currently, she is working on a project entitled *Thinking with Sound. A New Program in the Sciences and Humanities around 1900*. Her articles have appeared in journals including *Annals of Science, Technology and Culture, History of Humanities, Grey Room, The Public Historian, Cabinet, and Artefact*.



Hearing like an Animal. Acoustic Wellbeing beyond Human Ears



Judith Willkomm, University of Siegen, Germany

Hearing and acoustic wellbeing is anthropocentrically defined. This talk explores the technological interventions in the acoustic interaction between humans and animals. It will show, on the one hand, how sonic devices help to explore nature and the hearing abilities of animals, and on the other hand, how these media technologies and anthropogenic sounds have influenced animals and even threatened their wellbeing. The interplay between sonic devices and hearing animals was successful scientifically, but if one goes into the field a whole range of previously unreported epistemological practices emerge. Unearthed are for example the limits of human hearing abilities and how the technologically trained ear is able to surpass them. Looking at the interaction between environment, technology and users from a media-anthropology perspective sensitizes us for how a post-laboratory research practice imports and confronts normative understandings of sound(scapes), stretching the notion of acoustic wellbeing beyond humans.

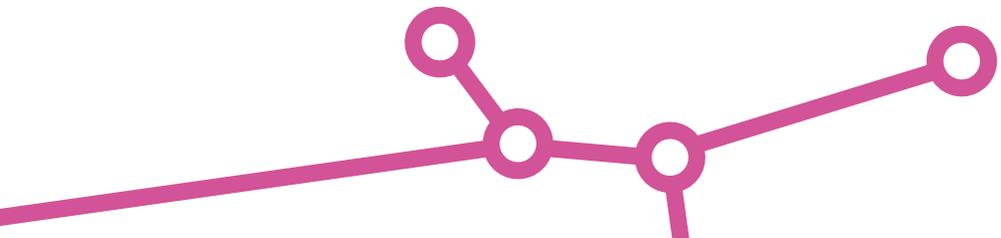
Judith Willkomm studied cultural anthropology and media theory at Humboldt University, Berlin. She holds a PhD in media studies. Currently she is working at the Collaborative Research Center “Media of Cooperation” at the University of Siegen. Her research focusses on the interplay of media technology and human senses. By taking into account the mutual influences of technical agency and epistemic practices her approach builds a bridge between classical media theory, science and technology studies and anthropology.

Ambient Experience for Exposure to Varying Tuning Systems on a Set of Musical Compositions

Mike Wright, Wrexham Glyndŵr University Wales, UK

Through auditioning of musical pieces, the disposition of the listener can be influenced by the choice of frequency ratios applied between the notes of scales. Exploration of Equal Temperament, Pythagorean, and Just Diatonic tuning can possibly change the personal emotive experience of the music. Does transposition of key normalised to the original frequency give a differing poignant aspect to music. A live experiment to see if participants can realise an affecting response will be applied, the result to be analysed and shared with the participants.

Michael Wright is Principal lecturer in Creative Media Technology, Wrexham Glyndŵr University Wales. He has a MSc Music Information Technology, City University, a BEng(Hons) Electrical & Electronic Engineering, University of Wales. Fellow of the Higher Education Academy as well as Member of the Audio Engineering Society, the Institute of Engineering Technology and the Radio Academy. He leads an academic area encompassing Theatre Performance, Humanities, and Creative Media Technology. Within CMT he delivers degrees in Music Tech, Sound Tech, TV production and Radio Production. Michael's background is in Music, Theatre, Radio, and Electronics. His career started with 10 years in technical theatre and music. Followed by 25 years in electronics and music. Interests in building synthesisers, Theremins, music interfaces. Also, perception of music and its influence on how we perceive musical relationships.



Hotel

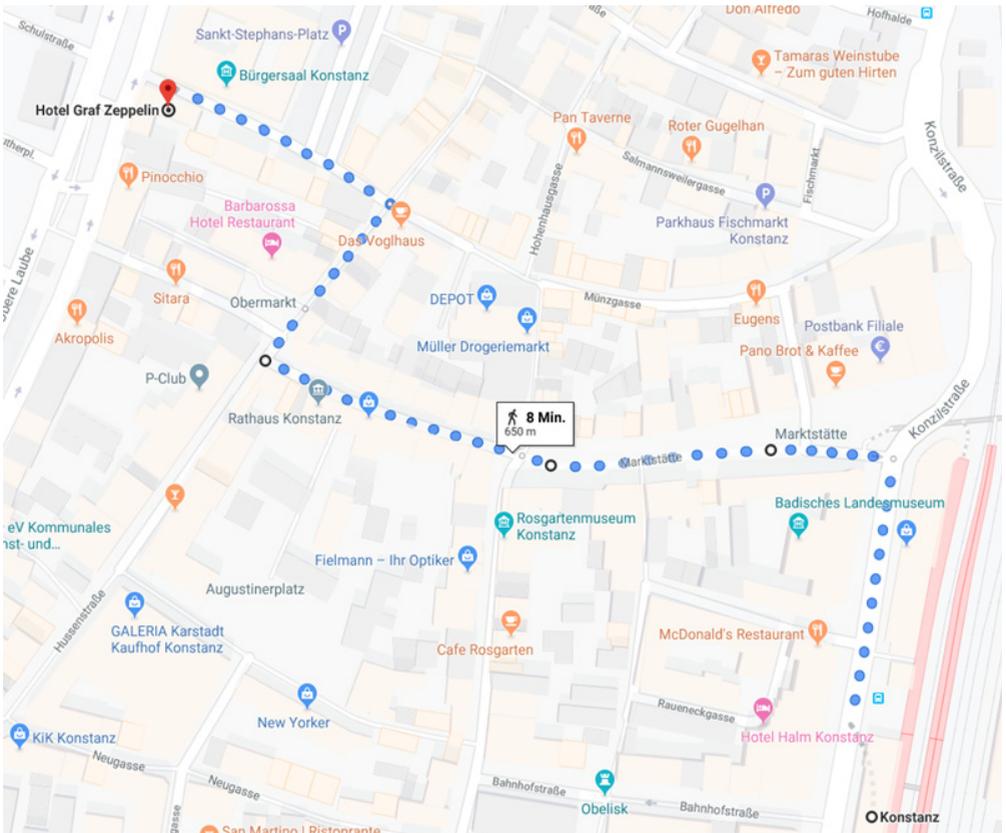
Hotel Graf Zeppelin

Sankt-Stephans-Platz 15, 78462 Konstanz

<https://www.hotel-graf-zeppelin.de/de/>

How to get there:

Leave the station and turn right to Bahnhofplatz. Turn left to Marktstätte and Kanzleistraße. Turn right to Obermarkt. Turning left to Sankt-Stephansplatz you reach the hotel.



Venue

Bischofsvilla, Universität Konstanz

Otto Adam Str. 5 Konstanz 78467

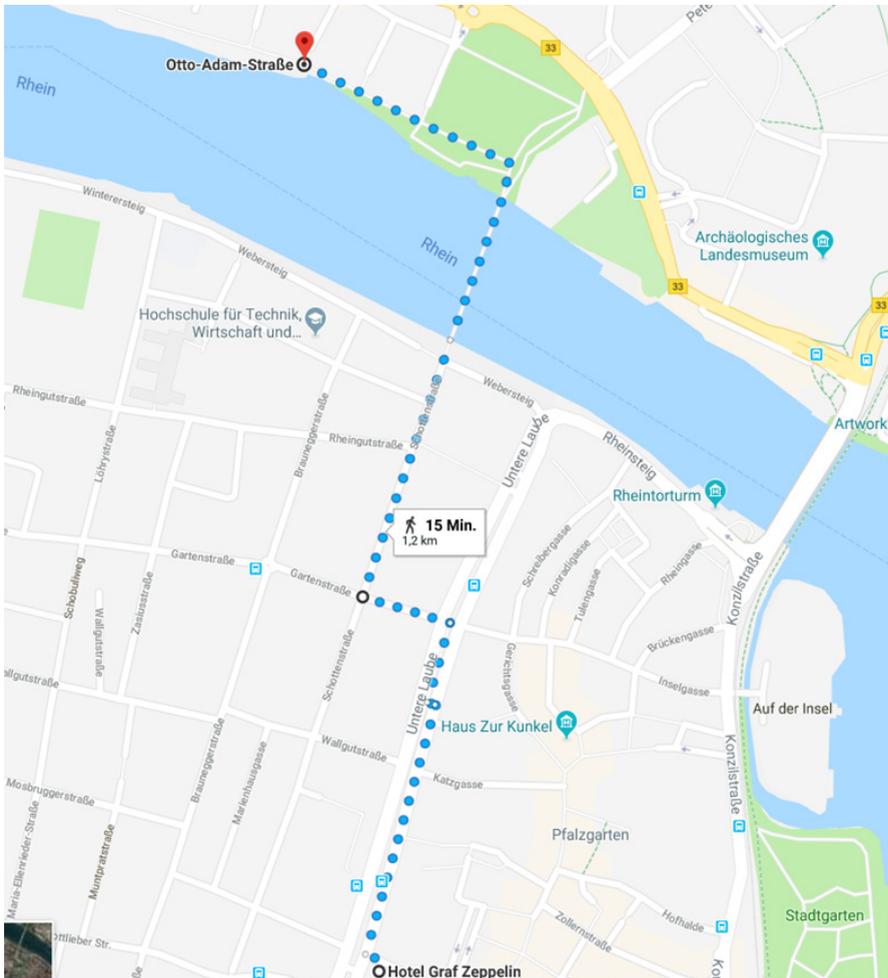
(Exact Position: <http://bit.ly/2FiWePC>)

How to get there:

From Hotel Graf Zeppelin turn right to Untere Laube. Cross the street and enter Gartenstraße. Turn right and take Schottenstraße. Cross the bridge. Turn left and after the park you reach the Bischofsvilla.

By Bus:

Take the bus lines 2, 3, 12 or 13 to the bus station Sternenplatz. Cross the street via tunnel and take Spanierstraße. After Herosé Park you reach the Bischofsvilla.



International Workshop

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and University of Exeter

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University of Konstanz
Professor Michael Schillmeier
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