THE SOUND DESIGN RENDEZVOUS

Paris, Thursday, January 19, 2017
IRCAM: Stravinsky Room

A sketch, a draft, is the starting point of any graphical conception in design or in architecture. The European project SkAT-VG aims to produce tools and methods for sound conception, letting sound designers use their voice and gestures to sketch out their initial ideas for the sound of an object or place. At the end of three years of collaborations among three research institutes, IUAV in Venice, KTH in Stockholm, IRCAM in Paris, and the company Genesis in Aix-en-Provence, the scientific results of the project concerning the production and perception of vocal and gesture imitations as well as the automatic recognition and analysis of these imitations will be presented on the closing day. Demonstrations of the tools and methods for sound sketches developed during the project will be featured in addition to scientific presentations.

Organisation:
Local committee: IRCAM-Centre Pompidou (France)
Scientific committee: IRCAM-Centre Pompidou (France), Genesis SA (France),
KTH (Sweden), IUAV (Italy)
http://skatvg.iuav.it/

Sound Design Rendezvous

Pleasant, yet functional. The fusion of these two adjectives describes most of the work of designers, in any domain. In the aural domain, designers aim at giving a pleasant and functional "voice" to the objects that will populate future soundscapes. Improved safety, health, and quality of life are the possible benefits for society at large.

The SkAT-VG project has been looking for ways to make the sound design process easier and more effective. The idea is to exploit the most natural tool for sound ideation - human voice and gestures - to develop intuitive sound design tools. Try imitating with your own voice the sound of a motorbike, an animal, the wind in the trees... Chances are that you are pretty good at it, especially with a little practice. Humans have surprising capabilities in communicating sound, but a thorough understanding of how this happens and how these capabilities could be exploited requires an ambitious research plan.

In SkAT-VG, three research institutions: IUAV in Venice, KTH in Stockholm, IRCAM in Paris and one company Genesis in Aix-en-Provence have joined their skills in perception, voice production, gestures, machine learning, sound synthesis, and interaction design to expand the scientific understanding in voice and gesture-based sound communication, as well as to introduce new tools and methods for sketching in sound design processes.

The possibilities and limitations of human voice and gestures as sound sketching apparati have been scrutinized by collection of multi-signal recordings of thousands of utterances, provided by both laypersons and voice professionals, and by their annotation and classification in relation to the sonic phenomena they were supposed to mimic.
It has been shown that vocal imitations generally have higher communicative power than verbal portraits of reference sounds, as humans naturally emphasize their characteristic features and reproduce them within the constraints of human vocal production, by analog or symbolic replication. A vocal imitation is not a cheap version of the referent sound, but rather an optimized representation that emphasizes only those features that are important for identification. The analysis of recordings has also shown that accompanying gestures have mainly an iconic function, with gestural metaphors that are largely shared across population.

Sound Design Rendezvous

In addition, the data collected during the project offer a rare opportunity to further enquire how people perceive, represent, and communicate about sounds. The large collection of video and audio recordings vocal and gestural imitations has been available to the research community.

The automatic extraction of the most relevant primitives of vocal and gestural imitations has been the leitmotiv of SkAT-VG research in machine learning, where several classifiers have been developed by exploitation of low-level acoustic features, emerging time-frequency components, and phonetic annotation. Once a sound category has been automatically extracted from an imitation, a sound model can be activated to synthesize that class of sounds, and it can be controlled by voice and gesture as well. This is the idea of sound design tools that SkAT-VG has been developing and testing, using two complementary sound synthesis approaches: The simulation of a physical process, as it is deduced from the imitation, and the exploitation of extracted primitives to weight and control pre-recorded audio corpora.

These original machine learning and sound synthesis algorithms are now available to the research community.

The SkAT-VG project has shown that vocal/gestural sketching can be as immediate and effective for sound design as drawing on paper is for visual design. A final sound-design prototype instrument has been developed and evaluated, which allows the designer to transform such sketches into versatile sound models that can be adapted and manipulated.

New design methodologies for sound creation have also been evaluated and refined.

These findings have the potential to re-define current sound design practices by including embodied interaction and cooperation in the creative flow.
Extensive interaction with professional and academic stakeholders has given valuable insights into how the research results can lead to product innovation. In the near future, designers might sketch novel responsive sounds, for a car or for a coffee maker, by using the whole expressive potential of their voice and body.

Thursday, January 19, 2017

IRCAM, Stravinsky Room

▶ 09.30-10.00
Davide Rocchesso (SkAT-VG project coordinator)
Introduction to the Sound Design Rendezvous

▶ 10.00-11.30
WHAT WE LEARNED
The SkAT-VG project has advanced scientific knowledge about how people communicate sounds by voice and gesture, and about how vocal and gestural sound sketching can be integrated in creative processes. Four talks will be given by the project partners.
· Sten Ternström (KTH)
  Production of Vocal Imitations
· Guillaume Lemaitre (IRCAM)
  Perception of Vocal and Gestural Imitations
· Geoffroy Peeters (IRCAM)
  Classification of Vocal and Gestural Imitations
· Stefano Delle Monache (IUAV)
  Sound Design

▶ **11.30-12.15**
Elif Özcan (Keynote speaker, Delft University of Technology)
Sound Design for Everyday Interactions

▶ 12.15-14.00
WHAT WE PRODUCED
The SkAT-VG project has developed prototype tools for sketching sound using voice and gesture.
· **Demonstrations**
  coordinated by Stefano Baldan (IUAV) and Clément Dendievel (GENESIS)

■ Lunch

Thursday, January 19, 2017

IRCAM, Stravinsky Room

▶ 14.00-14.45
Marc Leman (Keynote speaker, Ghent University)
Expressive Sound Design for Music-Based Biofeedback

▶ 14.45-15.00
AUDIOVISUALS
• *The Château La Coste Experience, 48h of Sound Design Workshop*,
  documentary by DDPO/Sylvestre Miget
• *The Brown Lipstick Sketches* (2016-2017), audiovisual piece by Andrea Cera

▶ 15.00-16.00
WHERE WE ARE HEADING TO
The SkAT-VG project is leaving a fertile ground and active threads in research, practice
and innovation. A focus on each topic will be presented by the project partners.
• Olivier Houix (IRCAM)
  Research
• Frederic Bevilacqua (IRCAM)
  Practice
• Patrick Boussard (GENESIS)
  Innovation

▶ 16.00-17.00
ROUND TABLE: PRACTICES OF SOUND DESIGN
Moderated by Davide Rocchesso, IUAV
With **William Rodriguez**, Sound Design and Ambient Lighting project leader – Direction
du Design Industriel – Groupe Renault, **Andrea Cera**, sound designer and composer,
Roland Cahen, enseignant-chercheur ENSCI Les Ateliers

▶ 17.00-17.30
Conclusion

Abstracts of Keynotes

MARC LEMAN
EXPRESSIVE SOUND DESIGN FOR MUSIC-BASED BIOFEEDBACK

My talk will be about a conceptual model for sound design for biofeedback systems in the domain of sports and rehabilitation. I will start from the notion of expression as defined in my book "The expressive moment" and explain how sound design could be approached from the viewpoint of interaction. This involves a dynamical systems perspective that incorporates the affordance for interaction as a main ingredient of sound design. I thereby focus on the 3Mo (monitoring, motivation and modification) model recently published in Frontiers of Neuroscience.

References:
- Leman M. (2016). *The Expressive Moment. How interaction (with music) shapes human empowerment.* Cambridge, MA: MIT Press.
- Maes P.-J., Buhmann J. and Leman M. (2016). 3Mo: A Model for Music-Based Biofeedback. *Front. Neurosci.* 10:548.

ELIF ÖZCAN
SOUND DESIGN FOR EVERYDAY INTERACTIONS

Sound design has always fascinated me. From my professional years as a sound designer, I remember the magical feeling of being able to give form to sounds, this seemingly intangible medium, and experiencing its immediate effect on me, both mentally and physically. For me, sound design equaled to working directly with sounds: Sketching with sounds, vocalizations, role-playing with sounds, and Foley artist tricks were part of my routine as a sound designer that helped me improve the acoustical quality of the sound itself. However, over the years the more I studied about the theories of product experience, human behavior, and mental processes, the more I have come to realize that there is more to designing sounds, especially sounds that belong to everyday products or everyday contexts. Everyday sounds and sound sources are always part of an episode in which people, other artifacts, a certain location or time interact with each other, and experiences of which are all blended. One cannot separate sounds from their ecological occurrence and its relevance to other daily activities. When designing sounds of everyday objects, it is equally important (and exciting!) to consider the context in which sounds are designed for and how users interact with their environment through sounds. Today, the whole world is fascinating to me with its inhabitants, environments, and artifacts, because that is where I find inspiration for sound design. In my talk, with commercial projects and current research activities, I will demonstrate how we design sounds for everyday interactions at Delft University of Technology. Some examples include the projects for Toyota Motors Europe, European Space Agency, and Erasmus University Medical Center.

Partners

GENESIS SA
http://genesis-acoustics.com/

GENESIS ACOUSTICS is a high-tech company founded in 1999 (SME), spin-off from CNRS-LMA. Its main activities are Sound Simulation, Sound Perception, and Sound Design and its main markets are the automotive (Renault, PSA, Volkswagen, Hyundai, Nissan, etc.) and the aeronautic industries (Airbus, Eurocopter, Dassault Aviation, Snecma, etc.). GENESIS spends more than 30 % of its activities in Research and Development projects (FUI, EC FP7 projects). GENESIS received an Award from the SFA (Société Française d'Acoustique) in 2005 for its technologies and involvement in research projects. The key know-hows of GENESIS are:

   Signal Processing, software development, real-time sound simulators
   3D sound and virtual reality
   Psychoacoustics
   Speech intelligibility

Among other realizations, GENESIS has developed LEA, a tool for sound quality assessment and sound design used by Dassault, Airbus, Snecma, Eurocopter. GENESIS was also expert on EC FP7 project, formerly SEFA and now COSMA (Patrick Boussard), about the sound simulation of aircraft and sound perception for community around airports.

Patrick Boussard (Local Manager) is the executive director and founder of GENESIS. He received master's degree in engineering from l'École Nationale des Arts and a master's degree in acoustics from the University of Aix-Marseille (1991). He has worked with the Laboratoire de Mécanique et d'Acoustique (LMA) du CNRS and for real-time sound simulation.

Christophe Lambourg is the technical director of GENESIS. He received a PhD degree in acoustics from the Université du Maine (1997, physical modeling of boards). He has worked for several acoustical engineering agencies and joined GENESIS in 2008. His specialties include signal processing, sound perception, microphone array design, speech intelligibility.

Hélène Lachambre is a research engineer at GENESIS. She obtained an engineer's degree in Electronics and Signal Processing from ENSEEIHT, Toulouse, France, and an MSc degree in Signal Processing from the National Polytechnic Institute of Toulouse, both in 2006. In 2009, she defended her PhD in Signal Processing and Computer Science at the University of Toulouse (Automatic analysis of music). After some years of research on speech and music analysis, she joined GENESIS in 2013. She is in charge of signal processing projects, software development (especially on LEA) and embedded development.

Partners

Guillaume Stempfel is a research engineer at GENESIS. After having obtained a master's degree in Computer Science from the University of Provence, he defended a PhD thesis in artificial intelligence (more precisely in statistical machine learning) in 2009. He joined GENESIS in 2010. He is in charge of R&D projects in signal processing, software architecture and software development (LEA and real-time sound simulation).

Clément Dendievel is a research engineer at GENESIS. He first studied music at conservatory, and then science as an engineer specializing in acoustics and industrial vibration at the UTC, Compiègne, France. After a first work in the field of automotive vibratory perception, he joined GENESIS in 2015. He is in charge of sound perception and sound design research.

IRCAM

http://www.ircam.fr/recherche/

The Institut de Recherche et Coordination Acoustique/Musique (IRCAM) is a non-profit research organisation founded in 1976. Its main activities include contemporary music production, R&D of music technologies, and music-related basic scientific research. The research at IRCAM covers the domains of sound analysis and synthesis, acoustics of musical instruments and concert halls, sound perception and design, music cognition, computer science. IRCAM has a research laboratory association with the French Centre National de la Recherche Scientifique and the University Pierre-et-Marie-Curie (STMS-IRCAM- CNRS-UPMC). IRCAM has participated to several European funded projects: Esprit (FP3), CUIDAD (FP4), WedelMusic, Carrouso, Listen, Agnula, Music Network, Listen (FP5), Semantic Hi-Fi , CROSS- MOD, i-Maestro (FP6), CLOSED, MINET, SAME, the SID COST action, Quaero, MIReS, Verve, 3DTVS and HC2 (FP7). IRCAM is also participating to several national projects funded by the French National Research Agency (ANR).

The Sound Perception and Design group (PDS) at IRCAM is Work Package leader for WP4 (perception and cognition of imitations) and WP5 (automatic recognition of imitations). Members of two other groups at IRCAM, the Real-Time Musical Interaction group (ISSM) and the Analysis/Synthesis group (A/S), will also be involved respectively in WP4 and WP5. The Sound Perception and Design group: Basic research activities of the group include loudness of non stationary sounds, everyday sound perception and recognition, sound signaling and sonic interaction design. The group participates to several applied projects in sound design. The group has coordinated the CLOSED European project (FP7) and is participating to several national projects (ANR).
The Real-Time Musical Interaction group: The IMTR group conducts research and development on interactive music systems, gesture and sound modeling, interactive music synthesis, gesture capture systems and interfaces. The targeted applications concern primarily music performance and the performing arts, but the team also collaborates regularly on industrial projects for the development of audio software, sound simulation and gaming.
The Analysis and Synthesis group: The A/S group carries out research and development activity into sound analysis, transformation and synthesis. The activities of the group include additive analysis/synthesis, automatic music indexing, control of sound synthesis for musical composition, orchestration, pitch recognition in a polyphonic context, processing by phase vocoder, and score following and alignment.

Partners

Patrick Susini (Local Manager) received a Ph.D degree in Acoustics in 1999, and a Habilitation in 2011. He is the head of the Sound Perception and Design group. His research activities include everyday sound perception, loudness and sound quality. He organised the 1st and 2nd international symposium in sound design in 2002 and 2004.

Nicolas Misdariis is a research fellow, graduated from an engineering school specialized in mechanics, a Master level on Acoustics and a PhD on synthesis/reproduction/perception of musical and environmental sounds. Since 1995, he has worked at Ircam in different fields of research dealing with sound science and technology. In 1999, he contributed to the constitution of the Ircam / Sound Design team where he has mainly developed works related to sound synthesis, diffusion technologies, environmental sound and soundscape perception, auditory display or interactive sonification.

Olivier Houix received the PhD degree in acoustics in 2003 from the Université du Maine, Le Mans. His research interests concern the perception of environmental sounds and the gesture-sound relationship in sound design. He teaches audio engineering at the ESBA TALM. He has been involved in national and European projects such as CLOSED.

Geoffroy Peeters received his Ph.D. degree in computer science from the Université Pierre et Marie Curie (Paris) in 2001. His current research interests are in signal processing and pattern matching applied to audio and music indexing: timbre description, sound classification, music classification, audio identification, rhythm description, music structure discovery.

Frédéric Bevilacqua is the head of the Real Time Musical Interactions team (ISSM). He holds a PhD from the Swiss Federal Institute of Technolgy in Lausanne (EPFL) in biomedical engineering. Since 2003, he has been conducting research at IRCAM on gesture analysis and on gesture-based musical interaction systems.

Guillaume Lemaitre studies how human listeners make sense of sounds and use sounds to interact with their environment. He received a Ph.D in Acoustics from the Université du Mans in 2004. Since 2000, he has worked with IRCAM, Carnegie Mellon University, IUAV University of Venice, Genesis Acoustics, and INRIA. His research activities include psychoacoustics, auditory cognition, auditori-motor interactions, and vocal imitations of sounds. His work has been applied to improve the sound quality of industrial products and human-computer interactions.

Enrico Marchetto received his Ph.D. degree in Information Engineering from the University of Padova in 2011. He was visiting researcher at KTH in 2010. He has been involved in the DREAM project (European Culture Programme – numerical real-time simulation of vintage electroacoustic instruments) and in technology transfer activities (start-up founder). Since 2013 he is at IRCAM, working on automatic recognition over large-scale audio datasets.

Jules Françoise received a PhD in Computer Science from Ircam and Université Pierre et Marie Curie, Paris. His research focuses on user-centered interaction design using interactive machine learning, with a focus on expressive movement and its interactions with sound. He has been involved as a postdoctoral researcher within the SkAT-VG project. http://julesfrancoise.com/

Partners

Gabriel Meseguer Brocal studied Telecommunications at Alicante University, Spain and obtained his MSc degree in Sound and Music Computing at Pompeu Fabra University, Barcelona, Spain. He developed his career as a researcher and developer in the domains of signal processing and machine learning. His current research topics are gestures description, identification and classification.

After English studies and in theatre, **Sylvie Benoit** is currently the assistant of the Ircam R&D department and one of the administrative of the FET project SkAT-VG.

IUAV
http://www.iuav.it/homepage/

The main educational and research activities of IUAV are focused on the construction and continual transformation of the physical environment: from cities and territories, to buildings and objects. Research and teaching intermix in an environment where Master students are involved in prototyping activities, and Doctoral students push the hottest theoretical issues. The Interaction unit, hosted by the Dipartimento di Culture del Progetto and headed by D. Rocchesso, is one of the most active research groups at IUAV. In the area of Sonic Interaction Design, the unit has coordinated a large international research network, the COST Action IC0601 on Sonic Interaction Design. The local coordinator and key researchers have been involved in previous EU projects. D. Rocchesso coordinated the project SOb (the Sounding Object), that developed versatile and efficient physics-based sound models, that could be easily integrated within artefacts and appliances. In the CLOSED (Closing the Loop Of Sound Evaluation and Design) project, the key researchers provided sound synthesis modules linked to the perceived characteristics of basic sound events. Within SkAT-VG, IUAV is mainly active in research on sound synthesis and sonic interaction design. The Interaction unit takes the responsibility of project coordination (WP1) and leads WP6 on sound synthesis.

Davide Rocchesso (Project Manager) is Associate Professor at IUAV where he teaches media processing and interaction design. He obtained his Ph.D. from the University of Padova in the field of sound processing, with special focus on physical modelling and spatial processing. Until 2006, Davide Rocchesso led the sound processing group at the University of Verona, where he coordinated the IST-FET project SOb, and he was local coordinator in the IST-FET Coordination Action S2S2 and in the NEST project CLOSED. He was Chair of the COST Action IC0601 on Sonic Interaction Design.

Stefano Delle Monache graduated in law at the Università Cattolica di Milano, and in electronic music and technologies of sound at Conservatorio di Como. In 2007/2008, he received a research grant at University of Verona in the scope of the CLOSED project. He obtained a PhD in design sciences at IUAV, where his research on product sounds is mainly related to the application of design methods and practices, including sketching, to a context of interaction design where auditory feedback is of central importance.

Partners

Ilaria Rosa has a master's degree in statistics and has been employed by different institutions for accounting and administration of regional and European projects.

Claudia Meoli has a master's degree in Literature and Culture of English Speaking Countries. She has been administrative assistante for a COST action and for the FET project SkAT-VG.

Stefano Baldan graduated in Information and Communication Technology at the University of Milan in 2011. During his activity as Ph.D candidate and research assistant he focused his interest on the symbolic representation of musical information, designing and implementing web applications for the advanced fruition of multimedia content using the IEEE 1599 standard. During his visit at Aalborg University Copenhagen he also collaborated to several Sonic Interaction Design projects, including the development of an auditory game for mobile devices based on rhythmic interaction.

Davide Andrea Mauro obtained a Ph.D. in Computer Science from Università degli Studi di Milano in 2012. His primary field of research is into music informatics, related to 3D audio, recording and reproduction techniques, with a specific interest for binaural spatialization. During the Ph.D. program he focused his research in the implementation of real-time spatialization systems combined with head-tracking techniques in order to render an environment coherently with the position of the listener. Former member of the IEEE Technical Committee on Computer Generated Music (TC CGM). Served as peer-reviewer for AES, CMMR, ICAD, ICMC, MMM, and SMC conferences.

Alan Del Piccolo graduated in Computer Sciences at the University of Udine in 2014. He is a Ph.D. candidate at Ca'Foscari University of Venice. He is currently focusing on the impact of auditory and haptic feedback on the interaction with 2D surfaces, and on the visual representation of auditory sketches.

Andrea Cera is an Italian electroacoustic composer, sound designer and sound installation artist. Cera graduated in Piano and Music Composition at the Conservatorio Cesare Pollini in Padova (Italy) and studied computer music at IRCAM, in Paris. He has participated to several research projects with IRCAM (Paris), NOTAM (Oslo), Integra Project, InfoMus Research Centre of University of Genoa, Phonotonic (Paris). Since 2009, he has been working with a car manufacturer (Renault) and a research team in sound perception and design (Ircam/SPD), for a series of sound signatures for electric vehicles. Since 2000, Cera has been working with several choreographers including Hervé Robbe at the Centre Chorégraphique National du Havre, Edmond Russo and Shlomi Tuizer, Pascal Montrouge, Les Ballets de Monte Carlo. Installation sites included Centre Georges Pompidou, Fresnoy Studio in Lille-Tourcoing, art galleries in Italy and France.

Partners

KTH
http://www.speech.kth.se/smc/smc_about.html

Kungliga Tekniska Högskolan (KTH) in Stockholm is Sweden's largest technical university. The Sound and Music Computing Group (SMC, formerly Music Acoustics) of the Department of Speech, Music and Hearing at KTH is the leader for WP2 (Case studies) and WP3 (Phonetic listening and world-event representation). In the KTH 2012 International Research Assessment Exercise, the Department was evaluated as part of Applied Computer Science, as, quote "Research output is internationally excellent in all fields, with a substantial number of units reaching the level of world-leading quality."
The SMC group has considerable experience of European projects and actions, such as MOSART, SoundingObject, Agnula, Marie Curie Training Site, S2S2, IMUTUS, VEMUS, and BrainTuning; as well as COST Actions IC0601 Sonic Interaction Design and 2103 Advanced Voice Function Assessment. One currently EU-funded project is EUNISON, which in its topic is complementary to the proposed SkAT-VG project. In addition, the SMC Group is in the same department as the well-known Speech Communication and Technology Group, with many points of convergence with the SkAT-VG project, and with very extensive experience of EU-funded projects.

Sten Ternström (Local Manager) received his Ph.D. in Music Acoustics at KTH in 1989, and has been professor of Music Acoustics since 2003. His research interests center on the human voice, but extend also across music, electronics, audio technology, computing and signal processing, subjects in which he also teaches. He has been principal investigator for numerous voice-related research projects, funded mostly by Swedish research councils and foundations. Ternström is the project coordinator of the FET-Open EUNISON project 2013-2016. Ternström co-founded and worked in a signal processing company 1995-2000 and has written commercial voice analysis software, in addition to some 60 scientific papers and book chapters. He is work package Leader and Local Coordinator for WP2 and WP3.

Pétur Helgason studies human articulation and the linguistic organization of sounds in speech. He holds a PhD in Phonetics from Stockholm University and has since been a senior lecturer at Uppsala University and, from 2016, at Stockholm University. His research activities include speech synthesis, articulatory analysis of speech, historical phonetics and linguistic phonology.

Anders Friberg, associate professor at KTH Royal Institute of Technology, has been working mainly with synthesis and analysis of music performance, including a rule system translating the score to performance. Recently, the focus has been on music perception including extraction of perceptual features from audio and its relation to ecological perception. In the SkAT-VG project, he works with the prediction of articulatory parameters from audio.

Gláucía Laís Salomão received her Ph.D. in Applied Linguistics in 2009 from PUC in São Paulo, Brazil; this included a scholarship for the doctoral stage carried out at TMH-KTH. Since 2010 she has been involved in various voice-related research projects at KTH as well as in cooperation with other European universities. From 2014 she has also been part of the research team at Stockholm University's Department of Linguistics for modeling audio-visual interactional cues throughout the period of the emergence of the child's first vocalizations and vocal imitations. Her main research interest is in the human voice and speech, in particular the relationships between voice production and perception vocal expression of emotions, phonetics, psycholinguistics, and multimodality in oral communication.

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