8th International Symposium on Temporal Design

Bologna, Teatro Comunale
September 14-15, 2017

Jointly organized by the **Italian Acoustics Association** (AIA)
and the Acoustics Research Team of **DIN, University of Bologna**

BOOK OF ABSTRACTS

curated by Dario D'Orazio

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1 Welcome to 8th ISTD

What is time? Unlikely "time is money", but "time is life". Then, what is life? There are three stages of life: The first (physical body) and the second (mind) are stages of life that are common to animal. Creations are the very activities in the third stage of human life and the environment might be designed for these three stages of life. If our life is limited to the two stages, however, these two levels of existence are never free from worry or ill treatment between individuals, further ethnic conflict or even war between nations. Freedom from these worries can be achieved in the third stage of human life. Theory of temporal and spatial design in architecture and the environment, our research sustains that by encouraging personal traits and satisfying individual needs, subjective preference works as an approach to enhancing individual health and creativity. Most generally, subjective preference is regarded as the primitive response of a living creature that entails judgments that steer an organism in the direction of maintaining life, so as to enhance its prospects for survival. Therefore, subjective preference may be deeply associated with the base of aesthetics. As an opening talk of the 8th ISTD, Bologna, it is highly recommended to adopt a concept of maximizing preference and minimizing stress in life keeping health throughout the life. It is proposed that preferences, when shaped into creations based on the individual personality in the third stage of our lives, carry within them the most survival power because they can self-sustain as culture. On a global level, such a realization may become "a second renaissance": an approach to development that is built upon the special talent of every individual and as such, representing an extension of each unique personality that has developed over a long course of time since the Big Bang. It is hoped that every participant of this symposium is aware of the third stage of life joining the second renaissance towards keeping world peace and individual health till end of life avoiding a number of stressors.

Yoichi Ando, Honorary President

It is with great pleasure that I welcome you to the 8th International Symposium on Temporal Design, ISTD 2017, in Bologna. I think it is an excellent opportunity for researchers to meet, exchange ideas, and establishing links, thus promoting the development of knowledge to improve the life of human beings. I hope that you will particularly benefit from the opportunity for cross-disciplinary discussions, as one of the goals of the Temporal Design theory is to widen the horizon of our vision beyond traditional boundaries. The program itself of the Symposium highlights the breadth of the coverage of the themes involved by the Temporal Design theory.

This is the first time ISTD has been held in Italy, so it is a wonderful opportunity for those from other part of the world to learn more about its ancient and vibrant culture and social life, and in particular to discover Bologna. The Symposium has been jointly organized by the Acoustics group at the Dept. of Industrial Engineering (DIN) of the University of Bologna and the Italian Acoustics Association (AIA), to whom I would like to address my deepest thanks for all their efforts. Last but not least, thank you to those who are participating and presenting their work to colleagues.

Massimo Garai, Chair of the 8th International Symposium of Temporal Design

Following the previous editions, the 8th ISTD is open both to academic and professional world. The attendance to the Symposium is composed for about one third of Italian researchers, one third of international researchers and one third of professionals. Furthermore recently graduated engineers will contribute to the poster prize and three young keynote speakers will talk alongside of one of the founders of temporal design in Italy. The low average age of the talkers must be warmly welcomed.

Quoting Prof. Kang's preface to 5th ISTD (2011), the 8th Symposium concerns mainly "acoustics in temporal approach". However the 8th ISTD includes other topics concerning temporal dynamism by hosting architects, philosophers, cognitive scientists, engineers, technicians and more. Organizers operated to find potential common fields: talks have been organized

in seven sessions over two days. We hope that the scheduling of the conference enhances connections and consciousness of the attendants.

Dario D'Orazio, Co-chair of the 8th International Symposium of Temporal Design

2 Bologna UNESCO Creative City of Music

In 2006 Bologna became a UNESCO Creative City of Music: a prestigious acknowledgement celebrating its rich musical tradition and its lively musical scene. For Bologna, music is tradition, creativity and identity. Music continues to be of an extraordinary importance for Bologna, the city's most prominent institutions being the Public Theatre (Teatro Comunale), the International Museum and Library of Music, the Padre Martini Conservatory, the Music and Theatre department of the University and the Philharmonic Academy.

Comune di Bologna

Bologna
UNESCO
City of Music

The UNESCO title recognises a rich creative fabric of musical production and consumption, in the form of important international festivals and a many cultural opportunities: important classical music seasons, contemporary music events, live jazz in local bars, events for children, the presence of young artists and bands and much more make for a unique musical panorama.

The UNESCO Creative City Network allows Bologna to instigate international exchanges, stimolate the growth of local business through collaborations with other cities, promote the musical sector of Bologna and encourage wider access to music and other innovative cultural phenomena.

The UNESCO Creative City Network promotes cooperation between cities, encouraging the development of interdisciplinary projects on a local and international level. In this frame, Bologna City of Music launches calls in collaboration with "Incredibol! Creative Innovation of Bologna", which are open on one side to creative cities in each sector for the participation in important events in the city of Bologna, on the other to local creatives for the participation in Festivals all over the world.

Just recently, on December 2017, the Bolognese creativity will be present at the Sound Design Festival in Hamamatsu (Japan), UNESCO Creative City of Music as well as Bologna. The event, focused on "Sound and Beyond", will gather creatives, companies and institutions to investigate the potential of sound in other fields of research like "media arts", medicine and welfare, through innovative projects and high levels of creativity.

For the same reasons, Bologna City of Music is happy to welcome The International Symposium on Temporal Design, which focus not only on traditional design but, in a more integrated approach, on interactions between human creativity and its effects on the natural environment, and notably between spaces and acoustic performances.

Luigi Virgolin, Economic Development and City Promotion Department – Municipality of Bologna

The UNESCO Creative Cities Network (UCCN) was created by UNESCO in 2004 to promote cooperation with and among cities that have identified creativity as a strategic factor for sustainable urban development. The network offers cultural operators to perform on an international stage, allowing them to project their local experience in a global context and enabling the development of cultural export and the creative industries. The Creative Cities Network is currently formed by 116 Members from 54 countries covering seven creative fields: Crafts Folk Art, Design, Film, Gastronomy, Literature, Music and Media Arts.

Info:
cittadellamusica.comune.bologna.it
facebook.com/bolognacittadellamusicaunesco
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3 Meeting Information

3.1 About Bologna

Piazza Maggiore is the ancient heart of Bologna. Its medieval buildings, witnesses of its vibrant public life and intense economic activity, combine with the latest functional places, while retaining their charm. A network of unique porticoes streets, that make the city unique, branches off from here. The porticos of Bologna, candidate for UNESCO world heritage, stretch out from the city center over 40 kilometers. Walking under the porticos, protected from the sun and the rain, it is possible to reach easily many important museums, galleries and religious buildings, which hold an unexpected patrimony of works of art. The University of Bologna is the oldest in Europe. The evidence of its prestigious history is spread out in many city places not to be missed. A completely unexpected surprise are the canals that date back to the twelfth century. Tourist Office is located in the center town (Piazza Maggiore, 1). Website: *www.bolognawelcome.com*

Bologna boasts a vibrant cultural life and an emerging creative economy. Local institutions and a multitude of cultural associations support its diverse cultural scene. Rooted in the citys glorious past, music is particularly relevant in Bologna today given the presence of leading institutions such as the opera house "Teatro Comunale", the International Music Library and Museum, the Conservatory dedicated to Father Martini, the Music and Performing Arts Department of the University of Bologna, and the Philharmonic Academy. Bologna stands out for its widespread promotion of the music sector, which is celebrated in a series of renowned International Festivals. Additionally, the remarkable classical music seasons, the contemporary music and jazz music program and children-targeted initiatives as well as the song-writers, rock-bands and other musicians who flock to the city, all contribute to making Bologna a truly unique center for music.

3.2 Transportation and travel

Bologna is connected by flight to the most important international airports. Bologna international airport is close to the city center. Website: *www.bologna-airport.it*
Bologna is connected by high-speed trains to the most important Italian cities (1 h from Milan, 2 h from Rome, 1 h from Venice, 0.5 h from Florence). Websites: *www.trenitalia.com* (national company), *www.italotreno.com* (private company).

3.3 Local transportation

All the places of the congress are near to the congress venue (Teatro Comunale, Piazza Verdi).
Bus company TPER Prices: Single trip ticket 1.30 eur, Day ticket 5 eur, "City Pass" – valid for 10 single trips – 12 eur. Bus from airport to town centre 6 eur. Website: *www.tper.it*
The Taxi-Company COTABO may be called by phone +39 051 372727. Taxi fare from Bologna Airport to town centre is about 20 eur. Website: *www.cotabo.it*

3.4 Parking information

APCOA operates park in central Bologna, Piazza VIII Agosto, Open 24h 7/7. Teatro Comunale, is an 10-minute walk from Piazza VIII Agosto car park. E-mail: bo.8agosto@apcoa.it, phone: +39 051 4222114. Rates: From 1st to 3rd hour, per hour or part thereof eur 2,55, From 4th to 6th hour, per hour or part thereof eur 1,95, From 7th to 11th hour, per hour or part thereof eur 1,25, 12th hour 0,25, Maximum daily rate eur 20,00.

3.5 Hotel informations

We got from some Hotels in the city centre special prices for the congress attendees. In some cases the price doesnt include the tourist tax (2-5 per person each night). **Please specify the code ISTD when you book the room**. Due to low availability during the symposium days, we suggest to book yuor room as soon is possible.

G. H. Majestic *****L
Via dellIndipendenza, 8. Price: Single room 250, twin or double 330. *bookingghmajestic@duetorrihotels.com*

Art Hotel Dei Commercianti ****
Via D Pignattari, 11. Price: Single room 116, twin or double 156. *arthotels.staff@inbo.it*

Best Western Hotel San Donato ****
Via Zamboni, 16. Price: Single room 99, twin or double 134. *info@hotelsandonato.it*

Hotel Metropolitan ***
via dell'Orso 6. Price: Single room 90, twin or double 120. *booking@hotelmetropolitan.com*

Hotel Roma ***
via Massimo DAzeglio 9 Price: Single room 92, twin or double 144. *prenotazioni@hotelroma.biz*

Hotel Palace Bologna ***
via Monte Grappa 9/2. Price: Single room 55, twin or double 75. *info@hotelpalacebologna.com*

3.6 Electricity

Electric sockets in Italy carry 220V/50Hz and conform to the standard continental type.

3.7 Registration

The registration desk – located the foyer Respighi of the Teatro Comunale – is open:
Wednesday, September 13 from 19:00 until 20:00
Thursday, September 14 from 8:30 until 18:00
Friday, September 15 from 8:30 until 13:00

3.8 Technical sessions

Theory and practice for temporal design, Sounds of city life, Auditory environment, Music thinking, Time-domain analysis, Measurement, perception and control at low frequencies, Performance spaces.

3.9 Student design contest

The Student Design Competition celebrates original design and rewards individuals and/or teams whose projects demonstrate innovative, functional design solutions that have a positive environmental and human impact, while allowing emerging professionals the opportunity to showcase their work and fresh design ideas to professionals working in the field. Prize: 1st place – 200 eur
Important Dates: Deadline to Enter: Monday, July 31, 2017
Winner will be selected by a jury of interior design and business professionals who will judge entries based on innovation and creativity, coherence and functionality, human impact, fulfillment of program requirements, and presentation of the information. Winner will be announced during the closing ceremony.

3.10 Selected papers on Journal of Temporal Design

Slides of presentations will be included in the symposium proceedings in a digital format and will be made available to the participants of 8th ISTD. Selected papers will have a publication opportunity in a issue of the *Journal of Temporal Design*. The publication is not mandatory and is free of charge for authors who attend the 8th ISTD. Instructions for authors at: *www.jtdweb.org*. Full papers must be sent until November 30, 2017.

Papers of the "performance space" section only will be published Official *Journal of the Italian Acoustical Association* (RIA).

3.11 Keynote speakers

Alessandro Cocchi

Emeritus Professor at University of Bologna. While researching in the fields of applied thermodynamics, fluid mechanics, heat transfer and heating and air conditioning, he also applied himself from 1972 to the fundamental and applied research on acoustics. Former President of the Acoustics commission of UNI (Italian Standardisation Organisation), former convenor of a C.E.N. (European Standardisation Committee) working group, and former expert of some ISO working groups. Former President and Secretary of the Emilia-Romagna section of the Italian Thermotechnical Association. Former President of the Italian Acoustics Association. Member of the American Society for Heating, Refrigerating and Air Conditioning Engineers (A.S.H.R.A.E.), of the American Society of Acoustics (A.S.A.), of the Institute of Noise Control Engineering (I.N.C.E.) and of the International Solar Energy Society (I.S.E.S.). He has ben member of the Integrated Regional Committee for the Atmospheric Pollution; member of the Commission for the Environmental Impact Statement and of the Commission on Airport Noise Control, both of the Ministry of the Environment. He is consultant of the City of Bologna for traffic, airport and high speed railways noise control. Organiser of A.T.I. Congress 1968, 2nd Int. Heat Pipe Conference 1976, A.I.A. Congresses 1985 and 1995, AICB International Congress 1995.

Elvira Di Bona

Polonsky Fellow at The Van Leer Jerusalem Institute (Israel), where she is developing a project on the admissible contents of auditory experience, which has been recently funded also by the Fondazione Franco e Marilisa Caligara at the University of Turin. She obtained the Ph.D. in Philosophy and Cognitive Sciences at Vita-Salute San Raffaele University (Milan) and the Institut Jean Nicod / École des Hautes Études en Sciences Sociales (Paris). She spent research periods at New York University as a Fulbright Scholar and the University of Sydney as an ARIA (Association for Research between Italy and Australasia) Grantee. She published articles on pitch, the auditory perception of causation, sound and temporality. In 2014, she was awarded a Fellowship from the Italian Academy of Columbia University (NYC), and in 2015 she worked on a project on aesthetic normativity sponsored by the Deutscher Akademischer Austausch Dienst (DAAD) at the Freie Universität Berlin. She completed the "High Specialization Course in Music Studies – Solo Violin Performance" at Accademia Nazionale di Santa Cecilia (Rome) in 2008. She performed in concerts of classical music – in solo performances and chamber orchestras – in the U.S., the U.K., Italy, Germany, France, Romania, Croatia, and Venezuela. Starting from 2012, she is the Artistic Director of "Voci dalla Montagna" ["Voices from the Mountains"], a festival of music and philosophy based in Pescasseroli (AQ, Italy).

Valentina Alena Girelli

Junior Assistant Professor at the Department of Civil, Chemical, Environmental and Materials Engineering of the University of Bologna. The three-year research program is entitled "Integration of advanced geomatic techniques for detecting and returning buildings and land" and is related to the 3D surveying methods, especially in the field of Cultural Heritage and in the multi-temporal study of the territory, in an integrated and multi-disciplinary approach. In July 2007 she got the PhD in Geodetic and Topographic Science, with a thesis centred about the analysis of the potentialities and problems in digital photogrammetric and laser scanning applications. During the PhD she has a three months education period at the ETH, Institute of Geodesy and Photogrammetry in Zurich; the research project is focused on the non-metric cameras calibration procedures and the 3D modelling of archaeological objects. Also she participates in the Archaeological Missions of the University of Bologna in Uzbekistan, in Turkey, and at Ercolano and Pompei in Italy, for the application of integrated geomatic techniques in archaeological areas. In 2009 she ranked third place in the National Award "Licinio Ferretti, photogrammetry of the twenty-first century: methods,

tools and applications." She is author of 37 scientific publications.

Andrea Prato

Postdoctoral researcher at the Acoustics Dept. at INRIM (Italian National Institute of Metrological Research). He earned his master's degree in Physics in 2011 from Universit di Torino. From 2012 to 2014 he has been a PhD student between INRIM and Politecnico di Torino with a thesis on Laboratory measurements of building acoustics at low frequencies: a modal approach, whereby he won the Sacerdote Prize from the Italian Acoustics Association in 2016 as best doctoral thesis in Acoustics. From 2015 he is postdoctoral researcher at INRIM. His main research fields are Acoustic Metrology, Building and Architectural Acoustics, Noise and Vibration Control, Sound Engineering. In the last years he also worked on the perception of low frequency noise and its effects on humans through performance, physiological and psychological analysis. Recently he investigated innovative methods for the laboratory measurement of airborne sound insulation at low frequencies and evaluated new primary calibration procedures for MEMS microphones. He is also an audio mastering engineer and musician.

3.12 Technical tours

3.12.1 L'immagine ritrovata

L'Immagine Ritrovata is a highly specialised film restoration laboratory. It was born and developed thanks to the good work of the Fondazione Cineteca di Bologna, with which the laboratory is in continual close collaboration. Today, L'Immagine Ritrovata is an international point of reference in the field, due to its development of methodologies, its constant research work and the vast range of its activities in the restoration of world cinematographic heritage. The equipment with which the laboratory is furnished - facilities that include all workflows, from 4K to photochemical - is at the forefront of technological innovation and is designed for the restoration of film from every cinematic age. More at http://www.immagineritrovata.it/

30 persons max are allowed to visit (15+15). Please book at the welcome desk.

3.12.2 Teatro Comunale of Bologna

The Teatro Malvezzi, built in 1651, burned down in February 1745 and this event prompted the construction of a new public theatre, the Nuovo Teatro Pubblico, as the Teatro Comunale was first called when it opened on 14 May 1763. Although he had been opposed by several others who lost the design competition, it was won by the architect Antonio Galli Bibiena and the theatre's inaugural performance was Gluck's *Il trionfo di Clelia*, an opera which the composer had written for the occasion. A bell-shaped auditorium consisting of four tiers of boxes plus a royal box and small gallery with a ceiling decorated as if open to the sky was built primarily of masonry as a protection against fire. However, much work remained unfinished, the facade in particular which was not completed until 1936. Backstage facilities which would allow the presentationsof operas were unfinished and only completed due to competition from another theatre in 1805. It was to be the first major opera house to be constructed with public funds and owned by the municipality. Although 35 of its 99 boxes were sold for private use, the terms of ownership were also unique in that they have been described as being limited to "the right to rent in perpetuity" rather than outright ownership and control. Various renovations were undertaken between 1818 and 1820 and also in 1853/54. After fire destroyed much of the stage area in 1931, the theatre was closed, and it did not re-open until 14 November 1935. By that date, the original bell-shaped auditorium had given way to a horseshoe-shaped one, seating 1,034 people. The 19th century saw the presentation of twenty operas by Gioacchino Rossini, while seven of Vincenzo Bellini's ten operas were presented in the 1830s. Works by Giuseppe Verdi and, later in 1871, the Italian premiére of Richard Wagner's *Lohengrin*, dominated the theatre's repertoire as the century progressed. In fact, Bologna became the location for several other Wagner opera premieres in Italy, notably with the composer present for his *Rienzi*, and the *Parsifal* premiere on 1 January 1914.

3.13 Guidelines for oral presentations

All presentations must be in English. There are no simultaneous translation facilities. Please speak slowly and clearly throughout your presentation to help those who are not native English speakers. Oral presentation should be prepared as a .ppt or .pdf file. Please adhere strictly to the 20 minutes allocated to your presentation. Plan for a 15 minutes presentation followed by 5 minutes for discussion). Follow any additional instructions given by your session chairpersons.

A technician is assigned to room and is in charge of the smooth running of your session. This person will be in the back of the session room and is at your disposal. Please feel free to introduce yourself and inquire about anything you might need. Please be in the session room and ready at least 20 minutes before the scheduled starting time of the session in order to meet the chairperson(s). In the session room, you will find a laptop, where you can see your presentation during your lecture. There are a number of stand-up microphones in each session room to facilitate the discussion.

3.14 Guidelines for poster presentations

Poster authors are requested to be present in their poster during the session (16.10 – 16.30). Size of poster board (usable space): 100 cm wide and 140 cm high (vertical). Please use a clear typeface.

3.15 Guidelines for manuscript preparation

Templates for manuscript preparation are available in Word and format. Please download the file www.jtdweb.org/template.zip

4 Program

	September 14	September 15
8.30	Registration	Registration
9.00	Opening Ceremony	Keynote 3 **The modern 3D digital geomatic techniques and their potential for the acoustic modeling**
9.30	Opening lecture **Maximizing preference and minimizing stress of life**	Oral Session 4 **Music thinking**
10.00	Keynote 1 **From Felsina to Bologna**	
10.30	Break	Break
10.50	Oral Session 1 **Theory and practice for temporal design**	Oral Session 5 **Time-domain analysis**
	Lunch	Lunch
13.15	Technical tour at The Comunale Theatre	Editorial meeting for Journal of Temporal Design
14.00	Keynote 2 **The Rich View of Auditory Experience**	Keynote 4 **Low frequency noise: an overview of laboratory investigations on human perception and building acoustics measurements**
14.30	Oral Session 2 **Auditory Environment**	Oral Session 6 **Measurement, perception and control at low frequencies**
16.10	Break and Poster Session: Student Design Competition	Break and Poster Session: Student Design Competition
16.30	Oral Session 3 **Sounds of city life**	Special Session 7 **Performance spaces**
18.30	Technical tour at L'immagine ritrovata	Closing Ceremony
20.00	Social dinner	Pre-dinner and live music

September, 13 2017

h. 18:00-20:00 Registration and welcome drink

September, 14 2017

h. 8:30 Registration

h. 9:00 Opening Ceremony

h. 9:30–10:00 Opening Talk

Maximizing preference and minimizing stress of life

Yoichi Ando
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A variety of stressors set into motion defense reactions mediated through the nervous and the hormonal systems. The word stress was not used until the 1950s, and the number of existing central hospitals was considerably lower. Nowadays, it is normative that human life is so occupied by a wide range of stressors that the pleasure derived from the process of living is regretfully often drained away by stress. This article has been written in support of healthy living. We shall discuss how to maximize a preference for human life in terms of environmental conditions, and, accordingly, how to minimize stress. Our preferences that shape into creations in the third stage of our lives carry within them the most survival power because they can self-sustain as culture. In short, the first stage in the evolution of life is the physical body, and the second stage is the mind. These two stages are common to all animals. These two levels of existence are never free from worry or ill treatment between individuals, further ethnic conflict or even war between nations. Creative actions, on the other hand, are indicative of human behavior and they are driven by preferences. The third stage refers to that part in the evolution of life whose influence spans across time-space and may, therefore, contribute to the health, happiness and overall conditions of future generations. Every creation is an extension of a persons unique personality and genetic code (DNA). DNA in its calculable forms has been developing since the Big Bang. As a phenomenon, it has undergone a fairly long-term life. Perhaps we can stretch the idea of a finite number of DNA to where it bears artistic and scientific works that are infinite in nature, and, therefore, contributing to human life as culture *ad aeternum*. In our context, the third stage stems from the body of our creations. Hopefully, an infinite countable number of unknowns may be tackled with a limited number of principles and theories created.

h. 10:00–10:30 Keynote 1

From Felsina to Bologna: historical development and temporal design

Alessandro Cocchi
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At the end of the 1st century B.C. Vitruvius wrote: The architect should be equipped with knowledge of many branches of study and varied kinds of learning, .. This knowledge is the child of practice and theory. While attaining in 2005 the 2th ISTD, I was asked to present some ideas at Kukubu Civic Center, where a new municipality was rising in these days: having in mind both Vitruvius books and Temporal Design theory, I exposed my view on this subject. Here I would like to analyze the historical development of Felsina, the ancient Etruscan settlement, up to the actual urban organization of Bologna metropolitan town. In this process, many aspects of Temporal Design in architecture will be picked up. In this actual urban organization we will also take into account the correspondence with the Andos three ages of human life, as I foresaw for Kukubu Municipality.

h 10:30–10:50 Break

h. 10.50–12.30 Oral Session 1
THEORY AND PRACTICE FOR TEMPORAL DESIGN

chair: Sergio Luzzi
Vie en.ro.se. Ingegneria, Firenze, Italy
sergio.luzzi@vienrose.it

Stress and preference factors determining the dialysis introduction age

Yoichi Ando
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Propose of this article is to discuss stressors and preference factors in human life determining the dialysis introduction age (DIA) based on the questionnaire distributing to the patients attending a hospital in Kobe, Japan. Results show that the most stress factor is human relation with trouble that makes younger DIA, and as preference factor drinking socially makes older the age.

As described above, the most significant factor causing an accelerated onset of DIA was troubled stress in interhuman relations. One effective way to eliminate such trouble is to take, for example, a two weeks' leave at least three times a year, avoiding the periods of Christmas season and summer time. Such conscious decisions mark an element of temporal design in ones life. The second significant factor was preferred alcoholic beverage, i.e., a glass of wine or cup of sake is said to be the best of all medicines to postpone the DIA. In fact, after a series of investigations on the effects of aircraft noise on unborn babies and children conducted near the Osaka International Airport, the author experienced the beginning of his kidney disease due to work stress and additional stress from the authorities. At that time he had good luck mediated by the Alexander von Humboldt Foundation, West Germany, where he was studying German at the Goethe–Institut in Boppard near the Rhine and could enjoy a glass of well-cooled white wine after each lunch looking over wonderful water flows. After two months, the research work on subjective preference of sound fields intended to take place in Goettingen for about one year and 8 months was conducted. After these pleasant experiences, the author's DIA was postponed for about 34 years due to manifest life preferences. The third significant factor was the past period of working hard, but this factor is somewhat related to aging, so that it is not simply concluded. In general, it is highly recommended to adopt a concept of maximizing preference and minimizing stress in life. The author has proposed that preferences, when shaped into creations based on the individual personality in the third stage of our lives, carry within them the most survival power because they can self-sustain as culture. On a global level, such a realization may become a second renaissance: an approach to development that is built upon the special talent of every individual and as such, an extension of each unique personality that has developed over a long course of time since the Big Bang. In short, the first stage in the evolution of life is the physical body, and the second stage is the mind. These two stages, however, are common to all animals. These two levels of existence are never free from worry or ill treatment between individuals, further ethnic conflict or even war between nations. Freedom from these worries can be achieved in the third stage of life.

Acoustics and global comfort in the habitat of Anthropocene

Sergio Luzzi and Rossella Natale
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The habitat (a word that in Latin language means "he lives") is the place whose physical and abiotic characteristics can allow a given species to live, develop, reproduce itself, guaranteeing quality of life, which can diminish or increase depending on climate change and/or demographic change. Anthropocene is a new geological period, dating from 1950, in which the main causes of territorial, structural and climatic changes are attributed to the human beings and to their activities. Landscapes and soundscapes of the inhabited world in the anthropocene are composed mainly of urban structures and infrastructures. Urbanization, and the related environmental and energetic issues, require profound reflections on how to design and build living and working spaces. The growing number of cities and of population in cities requires a growth in urban performance that currently

depends not only on presence of hard infrastructure but also, and increasingly so, on availability and quality of communication, social infrastructure, green areas.. In landscapes and soundscapes of anthropocene man-made elements and their sounds play a decisive and discriminating role in the urban scenarios, made of buildings, infrastructures, noisy and (hopefully) quiet areas. Choices made by urban planners, architects and engineers, in the creation and preservation of areas and buildings affect, both physically and emotionally, the quality of life of people in their own habitat The holistic design approach is based on the idea of safeguarding people's safety, health, and serenity, applying the principles of holistic engineering, bioarchitecture and Feng Shui architecture, respecting the laws of nature and harmonious development. In this integrated approach, acoustics plays an important role as one of the founding elements of the man-habitat-environment system. The holistic designers team should always be integrated with the competences of experts in environmental, building and room acoustics, since urban landscapes (and soundscapes) are perceived as world around us and not in front of us. In landscapes and soundscapes, perceived surroundings of the observer, where noise control and soundscapes design are crucial, the holistic approach aims to the pleasantness of places and global satisfaction of people considering sustainability like a positive karma that can stop the planet's degradation and the discomfort of its inhabitants. Smart and serendipic solutions should be considered as a part of this approach: smart mobility, housing, urban planning shows various connections with noise action plans. Serendipic attention can lead to added values in terms of acoustic benefits, not increasing costs, and vice–versa. Professional acousticians can assist the Local Governments in developing maps and actions plans: they can give qualified contribution for effective strategies and solutions for noise control, public health, land use and preservation. They should act as acoustic designer of actions and solutions for effective reduction of annoyance, for comfortable soundscapes in urban spaces, for listening good and comfortable sounds.

The holistic approach to habitat design

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As Holistic Medicine considers the human being as a whole and not as a result of organs and separated cells, Holistic Architecture provides the living space is not the product of many frameworks but a complete system "vibrating" with people who lives in it as well as its environment. The Holistic Design's main principle is the following one: everything surrounding us (external environment and habitat) mirrors our inside world. We can use this connection in order to enhance ourselves, starting from our surroundings and habitat. This approach, aiming at a happy habitats building, is based on 5 Holistic Designs mainstays: Safety, Health, Peace, Sustainability, Synergy. The first two mainstays concern human lifes protection and peoples habitats health. Safety means the feeling nothing bad would happen to our family and us. It takes shape through a proper structure design, systems, and surfaces and materials protection. Regarding Health, it is important to consider the habitats healthiness and comfort, as we spend at least 70% of our time indoor. The comfort level is set by many elements: some of them are physic (temperature, noise, etc.), some chemical and some biological. They can cause much diseases and illnesses when not checked. However, this is not enough, what really makes the difference is the third mainstay, Peace. It means harmony in our habitat as a result of shapes, colours, materials and sounds balance. Every indoor or outdoor space gets a special energy characteristic according to the elements they are made of. Every Design choice can or cannot achieve this balance. Living beings, plants and objects have got their own energy which reacts with ours, affecting it in a positive or in a negative way. Every person is connected to their surrounding through physical and earthly aspects as well as metaphysics ones, which vary in the time and the space. Feng Shui, the old Wind and Water Chinese art, calls *Qi* this Vital Energy. Applying its principles to Architecture means making the Men–Environment–Habitat System resound with the Natures laws which regulate its rhythms. This methodological approach which is the Holistic Engineering's base, matches perfectly with Temporal Design pursuing a quest for a dynamic and harmonic balance. Another paramount aspect is Sustainability. Natural, recycling and recycled materials, alternative energy and passive energy systems, natural lighting and ventilation use are just some themes for a good sustainable design, in order to improve comfort and any structures energy efficiency. We need to minimise the environmental impact and enhance the buildings performances in the circular economy framework, referring to the whole life circle of its materials and building processes. The single expertise and competence are no more enough to manage intricate and complex issues, so working in Synergy its necessary. Every expert needs to handle communication, personal and professional leadership tools at his/her best. The right development of all this procedures means design quality and actual good profits for the end user.

The silence of cemeteries, the silence of landscape

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Silence is a quality of contemporary cemeteries. Within their fences, in all European countries, many activities are permitted, such as walking, jogging, and reading. It is rare to picnic in cemeteries, and definitely impossible to sing or even speak, but perhaps whispering is permitted. Cemeteries allow the experience of silence. Silence is a structural experience in human existence, but its meaning is not univocal. (Christof Wulf, 1997) This paper would like to focus on two specific aspects. The first one is related to the specific quality of this cemeterial silence. The second one would be the meaning of this specific silence in relation to the human experience. The following considerations admit as their boundaries the fading ones of Western culture, diachronically investigated. The silence of cemeteries cannot be conceived as the absence of rumors or sounds. It is not the acoustic void of an anechoic chamber. Rather, the specific silence of cemeteries is the one which is the consequence of the absence of speaking. That is, the silence of cemeteries is properly *tacere*, to stop speaking instead of just being quiet. This silence is, therefore, the condition which allows for the active listening of: the specific context (that is landscape), your body (in the rhythm of breathing in and out), and your deepest feelings, emotions, and memories (Paul Celan, Il Meridiano, 1960). Silence is, therefore, the condition of listening to the self, in the exact process (or ritual) that the Italian poet Giacomo Leopardi synthetically and marvelously describes in "L'infinito". This kind of listening is deeply influenced by the landscape where it takes place. Cemeteries force the nostalgic element so that Memory, Melancholy and Silence appear to be bound together. This emphasizes on one side self-awareness, on the other the mindfulness of an irrecoverable and incommensurable loss, related not only to the flowing of time, but also and especially to the ephemeral nature of existence, in the perception of its boundaries, where to be and not to be face each other. The feeling of Nostalgia does not derive from the passing of the time, but to the fact that Chronos eats his own sons, so that the past is not just past, but it is actually lost. Silence is the contemporary Western answer to the feebleness of existence. It is a sacred silence which recognizes the existential question, but more and more struggles to give a (univocal) answer. Silence is the common reaction to a loss and a sense of existential precariousness to which contemporary society is no longer able to give a shared answer. Vice-versa, when a society is cohesive in the unity of a cultural and religious tradition, then even death can admit words, and the dead ones can share the loud life of the living, as it happened in the middle ages, as it happens in many African cultures. From its historical Christian roots, contemporary Europe inherits only the linear conception of time where the past is the place of certainties, the present is the time of challenges, and the future is the one of the biggest uncertainty until the certain, definitive disappearance. In this cultural framework, cemeteries play the role of places of memory and memento mori, as the whole landscape does due to its capacity of absorbing time and memories. The same concept of Landscape, as it emerges from the Romantic age, is able to convey a similar sense of Nostalgia due to its ability to show itself as a relic. The silence that produces the contemplation of a landscape corresponds to the same sense of loss which is inspired by cemeteries, as Eugenio Turri already stated[1]. Much earlier, DAnnunzio named "the cities of silence" not to cemeteries, but about a series of poems addressed to the Italian cities which had once been the center of cultural production and prosperous economies. We live perhaps in a paradoxical environment. While cemeteries, as spaces for the dead ones could suggest useful questions for the living, the landscape of the living, without these answers, has been transformed above all into an enormous cemetery, where the main common worry is only the maintenance of passing relics.

h 12:15 Lunch

h 13:15–14:00 Technical tour

Comunale Theatre

[1] "In relation to the becoming of all things, to their decaying and dying, is possible to associate only the silence. [...] The time of landscape is not the time of human beings.The time of landscape is the time of silence". (Eugenio Turri, Il paesaggio e il silenzio, 2004)

h. 14:00 Keynote 2
The Rich View of Auditory Experience

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What do we perceive when we have an auditory experience? Suppose that you are listening to a baby crying. While everyone agrees that we hear the pitch, the loudness and the timbre of the babys cries, not everyone agrees that we can literally hear that a baby is crying. Similarly, not everyone agrees that properties like being a voice, being the jiggling of a key or being a trumpet are perceptually (auditorily) experienceable. Two major positions on this topic have been defended in the literature. According to the thin view of auditory perception, while there is something which it is like to hear pitch, loudness and timbre, there is not something which is like to hear a speech sound, a glass breaking, a door slamming, or a baby crying. The contents of auditory phenomenology can include low-level properties like pitch loudness and timbre, but not high-level properties. In contrast, on what is called the rich view, we also have auditory access to the latter properties so that together with the low-level properties they constitute the auditory phenomenology. In this discussion, we will focus on the perception of environmental nonverbal sounds, the kind of sounds which normally surround us in everyday life, e.g., the sounds of people laughing, breaking glasses, crowds cheering, church bells and doorbells. In the literature, different methods have been proposed for determining whether a property is part of the content of perceptual experience. The technique which has been applied most widely is the method of contrast (Kriegel 2007; Siegel 2006, 2009, 2010; G. Strawson 1994/2010). One compares two situations which give rise to two different experiences (even if the sensory stimulation involved is the same), and then considers what resources the rich and thin views have to explain this difference in phenomenology. While the thin and rich views might agree on the fact that there is an overall phenomenal difference between the two experiences, they will tend to disagree on the explanation of this difference. Rich theorists typically argue that perceptual experience of high-level properties provide the best explanation for phenomenal differences between the elements of such a contrast case while thin theorists find some other way of accounting for this difference. Two other methods for testing the "perceivability" of a property have also been used. One is to describe the experience of the property in question, and see whether the experience has certain features which perceptual experience is generally taken to have. Claims about the characteristic features of perceptual experience can be initially justified by appealing to empirical data (Prinz 2006; Fish 2013; Block 2014; Di Bona 2016), or by considering everyday situations and by appealing to introspection (Masrour 2011). Another method for evaluating whether a property is part of our perceptual phenomenology is to examine pathological cases, and see if they reveal something relevant about perception in general (Bayne 2009; Nanay 2012). We argue that the property of being of a certain kind of sound, such as being a church bell or being a breaking of a glass, is among the admissible contents of auditory perception by using the hybrid methodology of analyzing a pathological case by virtue of the method of contrast.

h. 14:30–16:10 Oral Session 2
AUDITORY ENVIRONMENT

chair: Vincent Meelberg
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Auditory Objects: a new way to define old things

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The concept of "auditory object" has recently attracted much attention among neuroscientists, neuropsychologists, and philosophers. Although an auditory object is a sense-specific concept, it raises fundamental questions about the nature of object perception in all sensory systems. It has been

investigated in comparison with the visual object. Such analyses revealed not only how ontologically different the two objects aresince, while the visual object is often identified with material objects, the auditory object is equated with streams or eventsbut also how similar for certain aspects they appearfor the fact that both objects have perceptible qualities (i.e. color, dimension and size for the visual object, and pitch, loudness and timbre for the auditory object). The objective of this speech is to investigate the ontological nature of the auditory object, its specificity as an object of perception and its relation to the visual object. Furthermore, assuming that sound-perception can be considered a paradigmatic, albeit peculiar, case of time-perception, it will be aimed at: 1) clarifying in what sense there may be individual entities that exist only in time, focusing on auditory objects and 2) establishing what relationship links the existence of such purely temporal entities with the existence of spatiotemporal entities such as bodies or physical objects. The analysis might help to better understand the relation between such purely temporary entities and spatiotemporal entities (e.g. sound sources that generate acoustic waves). Finally, I will describe the process of temporal persistence in the formation of an auditory object, given that key to the grouping principles underlying sound perception is the idea of predictability: the auditory system must generate some sort of prediction from current and previously present sounds so as to build a model of what is likely to occur next. An auditory object can be isolated against the background, even before our conscious attention is directed to it. By contrast, to recognize the sound x as the same we heard a few seconds ago, we do need the intervention of some kind of attentional process, in at least one of the two-stage processes (to perceive and to remember the sound x as the same sound heard before). Probably, a specific purpose of our attention is to store each single sound separately when a new sound is coming to the system: our auditory system applies all possible grouping heuristics to determine whether the new sound can be fitted to the stored representations of the preceding sounds. But auditory objects are temporary-bounded objects, and their duration is always finite. Memory plays a crucial role in identifying and re-identifying them and, of course, it works as a short- or long-term storage of auditory information. Memory mechanisms are able to operate over a wide scope of timescales and auditory processing stages, including sensory memory traces in early auditory cortical areas. These are potentially fundamental to produce an integrated object percept to be included in our long-term storage, in higher-order areas that are able to extract meanings from sounds. The interplay between (predictive) perception, attention, and memory is crucial to study the role of temporality in enabling to separate distinct and meaningful perceptual individuals from an undifferentiated background.

On the perception of audified seismic data

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Auditory display, or "sonification" of scientific data has been applied successfully to research topics in several disciplines. Seismic data analysis naturally lends itself to audification: a particularly simple form of sonification which consists of accelerating seismic signals (whose frequency is lower than that of audible sound) before playing them through an audio reproduction system. We present a suite of experiments, designed to help determining whether the auditory display of seismic data can find practical applications in seismological research. Experiments consist essentially of asking listeners to (i) categorize audified seismograms that are presented to them binaurally, and (ii) define with a few lines of text (that we later analyzed semantically) the features of audified signals that helped them in completing this task. In a first experiment, listeners are presented with a set of audified recordings of the same earthquake, made by instruments deployed at different locations. They are asked to freely categorize these signals, i.e. to form their own categories, and are found to follow similar categorization strategies, which suggests the existence of auditory clues perceived by most of them. From these results it is, however, hard to identify a simple correlation between such clues and the multiple geophysical parameters (defining the Earths structure between source and receivers) that should in principle control the data. We thus implemented a second round of experiments, where listeners are assigned a constrained categorization task, and ad-hoc data sets are selected to isolate some specific geophysical parameters: this way, the sensitivity of the auditory system, via our display method, to such parameters can be evaluated directly. In one case the control parameter is the terrain, either oceanic or continental, sampled by the propagating seismic wave. In the other case it is the geometry of the seismic fault, which can be either thrust or strike-slip. The listeners are asked to associate each of a set of audified seismograms, that are presented to them

binaurally, to either one of the two categories. Results suggest that listeners are able to categorize signals according to the geophysical parameters we had chosen, and that their performance in this task can be improved by training. Our work opens the way to a number of potentially fruitful applications of auditory display to seismology.

Sound to Support Medicine: Designing Hospital Auditory Environments

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A hospital is supposed to be a place where patients receive treatment and have the opportunity to heal. The success of the healing process is not only determined by the treatment itself, but also by other factors, such as the lighting in the hospital, the way it is decorated, the temperature in the hospital wards, and how the hospital sounds. Sound can have a profound impact on patients, staff, and visitors in hospitals. Often, sounds in hospitals are experienced as stressful and disturbing. On the other hand, many of these disturbing sounds, however, convey meaningful information that is vital to the hospital staff. As a consequence, the experience of an auditory environment, i.e. the soundscape, of a hospital may at times be considered noise by patients, that is, as unwanted sound given one's current needs, goals, and activities, while at the same time consisting of important auditory cues for the hospital staff. This presentation will discuss strategies for designing positive auditory hospital environments. Examples of such designs will be discussed during the presentation, by relating them to four concepts that are relevant to this topic: soundscape, auditory environment, ambiance, and narrativity. The first two concepts, soundscape and auditory environment, are closely related. The term "auditory environment" refers to the actual sounds that can be perceived in a space, as well as the manner in which this space transforms, blocks, or amplifies these sounds. "Soundscape," on the other hand, refers to the manner in which an auditory environment is perceived and understood by an individual or by a community. In order to properly investigate hospital sounds and their influence on patients, visitors, and staff, the concepts auditory environment and "soundscape" are indispensable. The concept of ambiance addresses the interrelatedness of environments and the subjects that populate these environments. An ambiance can be defined as a space-time qualified from a sensory perspective, and foregrounds the interaction between the properties of an environment and the lived experience of its inhabitants. Ambiances are ongoing and temporal negotiations between the sensing body in relation to others and the environment. Ambiance therefore is a productive concept in order to analyse the impact of auditory environments in hospitals on its inhabitants. Narrativity, finally, is what makes a temporal phenomenon engaging for its observers. Narrative here is understood as a representation of a temporal development. It is a representation of sequence of logically and chronologically related events. This presentation will argue that a pleasant, positive hospital auditory environment is one that is not confusing to listeners, but is instead interpreted as a soundscape consisting of sequences of sounds that make

An historical and technological journey to multichannel sound for film

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In an influential 1953 article, acoustic consultant William B. Snow provided an overview of stereophonic sound. He emphasized the differences and similarities of various theoretical pickup and reproduction methods. From monoaural to diotic and binaural, from monophonic to stereophonic, the speech will go through the experiments, the drawbacks and the inventions that allowed tridimentional sound in music and film. We will analyze from a technical standpoint ancient and rare technologies, like the "theatrophone", and well underline the historical impact of multichannel pioneers, like conductor Leopold Stokowski; this technological/historical journey will eventually lead to the renowned Walt Disney animation "Fantasia", the mainstream grandfather of the multichannel sound for film.

The use of spherical and pseudospherical microphones in high quality sound recordings

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Sound recording evolution has seen the development of different techniques, due to the remarkable technological progresses and to the consequent almost infinite combination possibilities. Since the initial development of multi-transduction techniques, it has progressively become clear that temporal and energetic differences among the signals enable to define many important parameters about the definition of sound in space. One specific development direction is represented by the choice to interpose a "baffle" among the microphones to improve the mutual relationship among time differences and energy perceived by different transducers inside the very near sound field. We used all this solutions in the musical recording and reinforcement field, being able to understand the specific usage features inside different environments. On this theme, there have been and still are many possible variations as a function of specific market requirements. During the last 6 decades it has been possible to witness the differentiation of two research and development lines: one tended to a very trusty reproduction of a human head, the other preferred a simpler engineering solution limited to an as much as possible spherical shape. We will only deal with the 3D pseudospherical geometrical and present contribution will be limited to the use of two channels dummy head or similar solutions, which are defined "pure binaural". In this field, the so called "pure binaural" technique has been, due to different technical reasons, particularly appreciated in just a few musical sound recordings. The specific characteristics of the recording shooting spherical or pseudospherical systems are investigated through the phisical behaviour of an object in the acoustic field. The room Eigenmodes and the specific binaural characteristics of the transducing system are just a first step, which has inevitably to take then into account also the proprietary characteristics of the signals to be recorded. Even more important become then the reciprocal position of the sound sources among the room and the transducing system. Inside the specific use in the musical recordings, the performed music, the room choice, the musician's layout and the transduction system positioning will be enriched or spoiled by the mutual relationship between the direct sound and the spacial correlation of the diffuse sound field. In this cases, both the sound source directivity (very seldom singular and punctform) and the binaural transduction system will contribute to form the front-rear sensation too, so the analysis and the knowledge of the specific HRTFs need, can greately improve the musical finished and published product. The practical use in high quality and or niche recordings can indeed reveal interesting aspects, which the present paper will try to implement. In particular, we will approach a sound recording with pure Neumann KU100 and a recording with pure Schoeps KFM6, emphasizing the peculiar treatment in relationship with the room, the music and the musicians. KU100 has been used for a 1.000 years old gregorian chant recording in a Swiss monastery, whilst KFM6 has been used for an orchestral recording with soloist. It is true, that the peculiar characteristics of the two systems eventually promote a mixed use with other "spot" microphones in order to compensate the sound response rigidities of the pure binaural transduction system, but the combination of the acoustical field knowledges with the expertieses in the musical field, enable the use of pure binaural techniques to obtain excellent products, enjoiables from normal listeners on normal stereophonic reproduction systems, without the necessity to use headphones.

h. 16:10–16:30 Break – Poster Session: Student Design Competition

h. 16:30–18:10 Oral Session 3
SOUNDS OF CITY LIFE

chair: Giovanni Brambilla
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The perceived quality of soundscape in the archeological area of "Foro Romano" in Rome

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Notwithstanding over the recent years an increasing number of studies have been published on soundscape, proposing theoretical models for its characterization and practical approaches for its improvement, only a few dealt with archeological areas, like that performed in the excavations of Pompeii. However, with the UNESCO Convention for the safeguarding of the Intangible Cultural Heritage, the close connection between tangible and intangible cultural heritage was recognized and the concept of cultural heritage expanded. The archeological areas has the peculiar feature to include both tangible and intangible cultural heritage to create a unique cultural identity which can be as attractive for the tourists and as important for the local and global community. These areas are also interesting because their acoustic environment, formed by many sounds from tourists, outside recreational and commercial activities and surrounding road traffic, can greatly interfere with the individual enjoyment of the area. The present paper describes the study carried out within the SONORUS project, a Marie Curie Initial Training Network under the FP7 People Programme, aimed to plan the acoustic environment of cities in a holistic way supporting wellbeing and health of inhabitants. In particular, Rome was one of the four cities selected as test cases to apply the approach of urban sound planning. The area of Colosseum, Roman Forum and Palatine Hill was selected for its unique characteristics and importance, being the Italian most visited touristic site. To collect data on the sonic environment and appraisal of some environmental features, including a few non acoustic ones (like landscape and smell), 8 sites have been selected to cover different characteristics: from sites exposed to road traffic noise, to pedestrian ones and others thoroughly inside the archeological area. The acoustic data have been determined from binaural recordings taken at the above sites at the same time when subjective ratings were collected by a structured questionnaire filled in by people willing to do that. A total of 214 respondents participated to the survey, 90% of them were tourists. Statistical analyses, performed with the "R" software and packages "optCluster" and "caret", have been applied to extract main features and to classify the sites, as well as to develop a model to predict classification membership. The unsupervised learning algorithm of k-means clustering was applied. Among the solutions the one that groups the data into two categories looked the most appropriate considering the characteristics of the sites. In order to develop a model for predicting the cluster membership, logistic regression has been performed by the "caret" package available in the "R" software using k-fold cross validation (k=10) and 5 repetitions. The available data have been split into two sets, one used for training the model and the other for testing it. The results in terms of classification performance indices are rather promising.

On the influence of soundscape and lightscape design of public spaces on safety and social presence perception

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The urban environment is always perceived with a co-occurrence of information coming from different sensorial channels and visual processing, often considered as the main source of perception, is part of a larger network that combines sensory evaluations from a variety of sources. The use of bi-modal (i.e., visual and aural) experimental settings may therefore lead to a better evaluation of the environment experience and to the investigation of the influence of visual and auditory stimuli on the perception of spaces. This chapter addresses the effect of different soundscapes and lightscapes on the safety-related perception and the feeling of social presence in an urban open space through perceptive tests conducted in a laboratory. The chosen area for the experiment is a pedestrian passage under a flyover in the University campus of Sheffield, which had previously been the object of in-situ studies on the effect of soundscape on the duration of stay in the area. Visual renderings and auralisations have been realized through 3D Studio Max v.16 and Odeon v.13 respectively, on the

basis of a 3d model of the area, considering three different position of the observer/listener. As a first step of the research, in order to assess the influence of soundscape and lightscape design separately, two different test have been conducted. In the first one, only visual rendering corresponding to the actual lighting condition of the area have been presented to participants, while the five different acoustic environments have been superimposed to the same views. The five variables were the actual condition, a quieter condition obtained from the positioning of a sound barriers, and the addition of various music excerpts played by a set of loudspeakers placed under the flyover. In the second one, on the contrary, the soundscape has been kept unvaried, while three different lighting solutions have been inserted in the views, namely the actual condition, a functional lighting and a scenographic lighting. The two tests had the same structure, which consisted in ten questions that were repeated for each of the presented audio-visual scenario and to which participants had to answer using a five-point Likert scale. Both tests were conducted in the same environment (anechoic chamber of Politecnico di Torino) and using the same reproduction equipment for audio and visual stimuli, on order to keep the boundary conditions unvaried. Indeed, one of the main advantages of laboratory tests is the possibility to easily create different scenario through the controlled modification of specific aspects, and therefore to clearly evaluate the influence of every single aspect in the design of a public space. Results showed that both soundscape and lightscape have an influence on safety and social presence perception, and therefore a careful design of this two aspects of the urban environment might contribute to prevent the development of neglected spaces and no-go areas.

Expeditious and diffuse city noise mapping method on light zero emission vehicles

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We live everyday life in a rapidly changing environment and often noise maps or expansion plans do not keep up with this pace. Administrations (public services) often do not have a real overview of noise situation in their cities, thus it would be good to have a tool that monitors recent noise state allowing those who have to authorize a new building or even a new club to decide on an updated information. The idea is to set a class 1 sound meter and a GPS recorder on a silent light vehicle (i.e. bike). Then riding around the city under controlled speed but on random paths. Repeating this task over and over, night and day, we could collect a large and precise number of geo-referenced data. Last step is to set a processing algorithm that matches all data based on position and time, filter out disturbed registrations and create a set of noise maps at different hours (potentially with very short time slots). Finally, we may have an always updated noise scenario simply equipping a number of riders doing at the same time a patrol public service. Of course, the results may also be useful to other parties than public administrations.

Adding Complexity to Current Sound Studies on Public Urban Spaces

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At this moment I am involved in two projects dealing with sound in public spaces. The first one concerns a short tunnel for bikers and pedestrians connecting a public pathway with the botanic gardens of Leiden (the Netherlands). Plan is to also link these two sonically or to create at least a kind of transitory sonic space. The second project is a sonic analysis and reflection on a busy and rather hybrid square in Amsterdam, used by pedestrians, bikers, cars, and trams, but simultaneously meant for recreation, despite the traffic noise. Analysis and reflection take place in collaboration with sound artists, city planners, and residents. While traversing a city, we are surrounded by sounds. However, as we all know, sound is among the most significant, yet least-discussed, aspects of public spaces in urban environments (Hosokawa 1984; Kang and Schulte-Fortkamp 2016). Architects, engineers, and urban planners invariably stress the visual and tactile aspects while (re)designing urban environments but often pay less attention to the aural consequences of their interventions. Nevertheless, the sound design (or lack thereof) of a specific space highly influences our well-being (or lack thereof) and, therefore, whether that space is used in the way it was intended. Logical as it may seem, (re)designing, analyzing, and reflecting on the sounding aspects of a specific place is

almost always an anthropocentric affair. Bench-mark is the human individual and her relation to a sonic environment, most often reduced to statistical averages. My proposal for sound and solid sound studies on public (urban) spaces and it is this proposal that I like to present, albeit still in a nascent state is not so much to criticize this point of departure, but to pay attention to the many more, often non-human actants that can and should be included in the processes of analyzing, reflecting, and (re)designing. In order to do so, I introduce e.g. Bruno Latours Actor Network Theory and Levi Bryants Object Oriented Ontology into sound studies. The thesis I propose is that the interaction between the human individual and her sonic environment is only one of the possible interactions within a network of actants which determine (a) the sonic environment itself, and (b) the ways how it is assessed and evaluated. First, what the two projects, briefly described above, made clear is that a specific sonic situation for example depends on how materials act, react, and interact with each other: each sonic urban environment consists of a unique combination of organic and inorganic objects such as stone, concrete, plants, animals, water, glass, etc. Second, add to this influences from e.g. temperature, humidity, light, etc., all of them partly depending on the time of the day, season, and weather conditions. Three, as important are social, cultural, political, aesthetic, economic, ecological, historical, and even ethical actants which exceed but affect the sonic environment as well as how it is perceived. Four, emphasizing the aural component, does not mean to ignore the primarily visual, tactile, and/or olfactory actants in other words, sound studies should always be multi-sensorial. It is this complexity, this network of human and non-human actants, that interests me.

Eliciting acoustic design thinking with soundwalks and an interactive textile sonic map

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Many studies in soundscape research ask participants to categorise sonic events as the product of source activities. Despite allowing the subjects to directly categorise their cognitions, these studies are weak in capturing how the local sounds and acoustics will be differently perceived according to the listeners positions. We conducted soundwalks oriented towards listening to the acoustics of the place as naturally manifested during the walk. After listing the sonic textures they could hear in order of perceptual presence, participants were invited to place the perceived sounds on an egocentric circular space, allowing the researcher to measure their relative positioning. The binaural recordings captured during the soundwalk were also used to create an interactive textile sonic map, called Aural Fabric. This allowed participants to experience selected excerpts by touching the corresponded locations on the textile map, embroidered in conductive threads connected to a capacitive sensing board. The Aural Fabric engaged audiences on acoustic education themes by directly showing ambiences of different spaces from the same area. Its exploratory use was also assessed in controlled laboratory conditions, leading to an understanding of the influence of a key map when experiencing the device. We discuss the development of the concept and the extent to which it could be of interest for educators in acoustics or researchers in soundscape psychoacoustics.

h 18:30–19:30 Technical tour

L'immagine Ritrovata film restoring laboratory
via Riva Reno, 72

The visit is allowed to two groups of 15 persons: please book your visit at registration desk

h 20:00 Social dinner

Ristorante Cesarina
Via Santo Stefano, 19/B

September 15, 2017

h. 8:30 Registration

h. 9:00–9:30 Keynote 3

The modern 3D digital geomatic techniques and their potential for the acoustic modeling

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Nowadays the production of 3D models of spaces and objects has become an important research field in many scientific areas for very different applications: robotics, navigation, medicine, body scanning, reverse and civil engineering, industrial inspection, cultural heritage, entertainment. Geomatics provide a wide range of powerful and flexible tools for obtaining 3D models of an object. Generally it is possible to choose among three different approaches for the surveying, studying and representation of an object: (i) passive or image-based techniques, like digital photogrammetry; (ii) active or range-based techniques, as for example laser scanner; (iii) a combination of passive and active techniques; in fact no method is able by itself to satisfy at the same time all the requirements of the 3D modeling and an integrated approach is often the best solution. The choice of using a specific instrument depends on different key factors: the object size, the requested accuracy, the characteristics of the generated final products, the economic and logistic constraints. In any case, laser scanner and digital photogrammetry today allow to generate textured 3D models thanks to their capability to combine an accurate geometric information with a rich photographic and qualitative description of the objects. In many cases of study the available photo-textured 3D model of the interested object constitutes the base of a process of documentation, study and analysis at a higher level than that allowed by the traditional methods; some examples, in different fields of application, are the cases of the readability of epigraphs and inscriptions in objects as stela or bas-reliefs, the characterization of road pavements surface texture, the monitoring of surface decay evolution in outdoors brick masonry, the analysis of the fracture surface in composite materials. A new experimentation is about the use of the modern 3D geomatic techniques in support of the acoustic modeling. Currently, 3D models used for the acoustic modeling of indoor environments such as opera houses or concert halls, are usually derived from existing plans, sometimes integrated by insufficient direct measurements; these data are often incomplete, not revised and inaccurate. Laser scanner and digital photogrammetry permit to describe the macro and the micro geometry of a space; in fact by these techniques it is possible to measure very dense 3D point clouds that, appropriately processed, allow to reconstruct the geometry of the interested object with high metric precision. These methods permit also to acquire the position and the shape of architectural particulars not easily measurable, for example scenery flats and boxes in a theatre, extremely important in the study of the acoustic performance of the environment; besides, the analysis of the micro geometry of the surfaces can help the characterization of the acoustic properties of the materials, as diffusion index.

h. 9:30–10:30 Oral Session 4
MUSIC THINKING

chair: Riccardo Wanke
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A study of perceptual assessments of sound in current experimental music genres

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Within todays experimental music scene, several currents of classical contemporary music, post-spectralism, minimalism, electroacoustic music, glitch and IDMs (intelligent dance music) offshoots can be seen to share a similar perspective in approaching sound, despite the distance between their contexts (Solomos, 2013) and in some cases, they can be brought together under a common perspective in which sound seems to possess tactile qualities, volume, density and grain (Wanke, 2015). Trained and untrained listeners were asked to evaluate short musical excerpts[2], but with all excerpts belonging to a common aesthetic frame of reference, namely an approach to sound as a material substance. First participants[3] are invited to freely sort audio extracts into groups and to indicate which criteria they applied in creating these groups; second, they are asked to associate each extract with up to five descriptors from a given list. The second task benefits from a set of structural semantic descriptors, which focus on sounds qualities (e.g. heterogeneous, ascending, fluctuating, repetitive) and come from the results of a previous analysis of the same selection of pieces. Trained participants showed a greater ability to: distinguish styles and genres; identify the source of different sounds; deal with semantic descriptors from different spheres of sensation other than hearing and usually prefer those concerning nature and behaviour of sound (descending, contrasting, sculptural). Untrained participants favour more general descriptors (static, rhythmic) as well as those that relate to the effect of music (hypnotic). In general, it seems to be more demanding to express verbally one's own musical decisions than apply given designations. The sorting task confirms that the perceptual response to a diverse collection of experimental music would naturally draw on a sort of analytic listening that allows the listener to identify contextual elements (styles and instrumentation), and a description of personal emotive associations (affective listening). A third tendency emerges (immanent listening): some participants took an approach to sorting that appears more like an effort to describe music through an act of apprehension of material aspects of sound in the form of profile, shapes and evolutions. This work addresses the difficulties in conveying our perception of these styles of music and reveals different listening attitudes. It demonstrates that the development of new aesthetic frameworks, a common perspective to discuss perceptual interpretations and connections across genres may be the first steps necessary for new points of convergence within the world of contemporary experimental music to occur.

Dynamical Fundamentals of Music Thinking beyond d'Alembert Statics

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Modern Western Music Thinking is established by those pioneers in 16-18th century mostly in Italy, France and Germany: Namely from Gioseffo Zarlino, Vincenzo Galilei to Jean-Philippe Rameau and Johan Sebastian Bach, and fundamental framework of those above are characterized by Wave equation(s) by Jean Le Rond d'Alembert. It naturally has theoretical limitation of determinism and reversibility which annoyed Ludwig Boltzmann tragically against H theorem, irreversibility and the arrow of time. Music is a form of Mimesis = state of human mind and all cognitive phenomena cant avoid the regulation of time-dependent transient nature of irreversibility. In this paper theoretical limit of dAlembert Statics are clearly shown and dynamical frameworks for practical music thinking is proposed.

Scores of architecture

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The core of this research is the appropriation of the time dimension within the architectural language and of space dimension within the musical language. Scores of architecture has a structure consisting of drawings, sounds and text. The hypothesis of space takes place through drawings

[2]Pieces by G. F. Haas, B. Lang, G. Verrando, Pan Sonic and Raime.
[3]N = 75, average age mid-thirties, a majority reported a prior (semi)professional link to music through being students of music or musicology (53%), musicians (69%) and scholars (17%).

and audio tracks, interpreting the various aspects explored, while the text outlines some theoretical issues relating to architectural and time compositional aspects. In a mutual exchange of the reciprocal application areas, languages overlap appropriating their grammar and vocabulary that distinguish them. This contamination process widens and strengthens the compositional process by exploring the complementarity between space and sound. In the exchange process, languages achieve such a level of interpenetration that generates new analytical- design devices. Architecture gets hold of compositional elements such as interval, scale, dynamics, performance, modulation, cyclicality, harmony, melodic development, alignment, downshift, rhythm. The very word 'structure' can be released from the most common meanings of building, 'functional element', 'essential pillar' to suit other 'more musical' ones, such as distribution of sound materials over time, relationship between the parties, 'theme elaboration and development'. In the same way, the concept of measure can be transposed and become the temporal dimension of the lived space. Contemporary music needed to develop a new lexicon able to provide descriptive objects for new music (electro-acoustic music on all), with terms such as color, materiality, density and scarcity, direction and trajectories. Similarly, it is possible elements and terminologies, that it already owns but in a reworked key, to be returned to architecture, conceiving a musical architecture in which the time element is significant in the construction of the space idea. In this study the description is not limited to the spatial composition of generic places of the built, but it also interprets the time dimension by proposing styles and types of use. The propensity to walkability within the spaces actually puts time dimension into the graph. This work does not aim at inventing future buildings but at communicating a planning purpose by looking into the linguistic structures of a possible architectural layout[4]. The drawings and the compositions so far developed in the study do not refer to a recognizable built place, but only to a spatial structure that is defined in terms of internal relationships and may therefore be modified, enlarged or reduced on the basis of the needs. The choice of the compositional instrument, based on mutual exchange between the two spheres, therefore allows to transfer the architectural language from the graphic level, expressed in the three spatial dimensions, to the musical one, that intervenes and exists only within the fourth dimension. Living a space means taking it up not only physically but above all temporally.

h 10:30–10.50 Break

h. 10:50–12:50 Oral Session 5
TIME-DOMAIN ANALYSIS

chair: Ryota Shimokura
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Problem-solving researches on hearing aid

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Although a hearing aid has been developed in terms of sound quality by the digital signal processing and wireless data transmission by the Bluetooth, it still has two unsolved problems. One of them is that the interface for the users is always earplugs. The earplug occludes the external auditory canals, and the annoyance by the occlusions makes the users giving up the daily use. The second one is that the hearing aid can not improve the speech intelligibility for patients with sensorineural hearing loss (i.e., presbycusis). They can hear the amplified sound by the hearing aid, but they can not identify the words because of damage in the inner ear and auditory nerve. Thus, for them, hearing aids may offer limited benefits when used during conversations. For the first problem, we have developed a cartilage conduction hearing aid. A ring-shaped transducers are put on the both entrances of external auditory canals, and the vibrated transducers activate the aural cartilage which forms the outer ear and is distributed around the exterior half of the external auditory canal. The vibrated aural cartilage generates air-borne sound directly in the external auditory canals, but the ring shape keeps the ventilation of the canals. The amplification gain is 50 dB at a maximum and 35 dB in an average, which is no less than conventional hearing aids. And the binaural effects can

[4]M. Congiu, M. Garau, Writing Architectural Narratives, Tangram Edizioni Scientifiche, Trento 2012, p. 10

be valid by putting the transducers in both ears. For the second problem, we have researched the less discernible consonants within Japanese monosyllables for the patients with sensorineural hearing loss. In a monosyllable, the first consonant part is constructed by noisy elements, and the successive vowel part is a periodical signal synchronized a fundamental frequency of the voice. Our work reported that the monosyllables with lower SN ratio were hard to be identified by them. The SN ratio of monosyllable can be quantified by an effective duration (τ_e) of an autocorrelation analysis which is an established method of temporal analysis for auditory nerve processes. Aged people may catch the words more clearly by introducing the autocorrelation analysis in the digital signal processings of hearing aid.

Using time in the evaluation of effortful speech recognition

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An optimal speech communication can be achieved if the message transferred from talker to listener is fully received, and the process does minimize the effort required. An optimal speech transmission is especially required during educational activities, but such conditions are also needed in public spaces where noise may hamper speech reception making it an effortful process. At present a number of metrics have been developed to assess listeners accuracy in the speech reception, for instance in terms of items correctly identified. They are based either on direct testing word recognition in situ with people or on measuring dedicated acoustical indicators. Unfortunately, these tools are not much effective in tracking the listening effort, whose evaluation calls for an extension of the analysis beyond acoustical quantities. In the field of audiology the construct of listening effort has acquired increasing interest and several methods have been developed for its qualification. In particular psycho-physiological measures are used such as pupillometry, skin conductance, hear rate etc.. which, depending on the monitored quantity, are able to track the changes of autonomous nervous system (either sympathetic, para-sympathetic or both). These unconscious reactions are informative with respect to the attention and the mental effort put in the speech reception process, and hence are associated with listening effort. Besides psycho-physiological indicators, also behavioral measures can be used to describe listening effort. In particular it has been shown that response time to the auditory speech stimulus can provide useful information on the overload of cognitive resources that occurs when listening in challenging conditions. In fact the slowing down of response time indicates an increasing demand of cognitive processing caused by the listening conditions. This quantity is comprehensive by definition, since involves several subjective components related to cognitive and attitudinal factors. For this reason a careful control of experimental conditions and a dedicated data analysis are necessary. Even though, the response time has the great advantage of simplicity and, compared to the former quantities, an easier implementation for in situ or lab tests is possible. The usage of response time has disclosed several phenomena that could not be described by simply analyzing the amount of correctly identified items. First, in an in situ experiment the so-called release from effort was outlined, meaning that an equal percentage of items correctly spotted was achieved in a shorter time. In a later study it was discovered that pupils in classrooms are responding differently to traffic, impact and activity noise when they are monitored during a lesson period. Finally a recent investigation showed that the speech-like fluctuating noise typical of many reverberant public spaces (e.g. restaurants, offices, open plan classrooms, etc..) is more effortful than stationary noise to achieve the same recognition rate when a set of four words is presented. In conclusion, from the studies so far it appears that response time is useful in view for optimizing the listening experience and thus it is fostered as a design variable for room acoustics.

Envelope extraction for early decay estimation: a subjective survey

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The Schroeder's backward integration method and its applications have been widely studied in the literature; some papers analyse the performance of the method, some others suggest various enhancement techniques. In spite of these findings, there exist several cases where the energy decay curve extracted using the classical backward integration method and the parameters computed from it seem not always representative of the phenomenon under study. Among them, the case where the early decay is dependent on strong, distinct reflections occurring just after the direct wave, as in most Italian opera houses. Other cases are measured impulse responses with a very low signal-to-noise ratio or missing the direct wave. In the literature, alternatives to the Schroeder's method have been proposed, ranging from Hilbert transform to non-linear processing techniques. In a previous work a method for the extraction of the envelope based on pre-processed energy detection for early decay estimation is proposed. It was shown that it returns an envelope well matching the first part of the decay even in non-linear cases, returning detailed information on the first part of the decay. In the present work a study on the perceptive relevance of the method is presented. A paired comparison tests was performed by supplying six pairs of stimuli to the assessors, who had to declare which sound track was felt 'more reverberant'. The stimuli were pairs of auralisations in which the convolved room impulse responses had EDT values that were equal if calculated with the Schroeder integral, but exceeded the JND if calculated with the envelope-based method. Assessors declared to perceive a greater reverberance for the motifs in which the EDT value calculated with the envelope-based method was greater.

The recent shift in Machine Hearing: from Engineered Features to Time-Domain Raw Audio Processing

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In recent years Deep Neural Networks (DNN) obtained extremely valuable results in the fields of audio and music, and specifically in classification tasks (novelty detection, classification of acoustic events, musical instrument classification, genre classification, and so forth). Established methods for classification and regression tasks required a high-level representation of the audio signal, such as frequency and time-frequency domain transforms (DFT, DWT, STFT, MFCC, etc.), temporal or spectral indicators (energy, envelope, spectral flux, spectral centroid, etc.), or task-specific hand-engineerd features. In other words, Machine Learning (ML) algorithms and Digital Signal Processing (DSP) were employed cooperatively but in a feedforward fashion, with the DSP algorithms generally devoted to pre- and post-processing. Since 2016 a new wave of research works showed how to generate audio sequences for speech production and music generation, see e.g. Wavenet and NSynth from Google Deep Mind and sampleRNN from Mehri et al. What is interesting about these works is that they exploit the neural network architecture itself to extract meaningful machine-learned features. This recent approach is termed "end-to-end" in the Machine Learning literature, because it needs no additional processing beside the neural network itself. Besides being elegant and cleaner from a theoretical standpoint, it is highly appreciated by the ML community because it removes the need for a deep knowledge in both DSP and ML fields and it reduces the long developing cycles spent on guessing, coding and testing many hand-crafted features. I will show how this approach is interesting in building new Machine Perception models. On the other side I will argue about some weak points inherent to the end-to-end approach such as computational cost and accuracy in musical tasks such as sound design and timbre analysis. I will also show parallels between DSP-based approaches and end-to-end approaches to demonstrate that there is still lots to learn and draw from the DSP literature to build (possibly adaptive) feature learning. The talk will provide a review and a comparison of feature extraction versus end-to-end methods in the fields of music information retrieval and sound synthesis and will discuss all the points outlined above.

ACF-based scream classification for detecting hazardous situations

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This study aims to detect and extract the female scream in the real-time recorded sounds. After detection, classification was performed based on running ACF parameters. It was assumed that the female scream may have different types of emotional process, so it is further divided into three categories: Scream A - 'scare', Scream B - 'piercing shriek' and Scream C - 'acute pain'. To investigate the emotional differences, the ACF parameters were used and the average value of tau-e in running ACF is computed. It was found that the Scream B has large variations of Tau-e in its waveforms whereas scream As waveform is flat, resulting in higher values for Scream B as compared to Scream A. In addition, the values for both tau-1 and phi-1 of Scream C show a strong tendency for starting frames of rACF. These differences are also supported by spectral details. Based on the threshold criteria, the emotional characteristics in the screams are extracted. Screams from different subjects having different tonal characteristics need to be further considered and false predictions should be considered to quantify the accuracy of a proposed algorithm.

MIMO auralisations of Teatro Comunale in Bologna

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The case of Italian Opera houses represents a unique circumstance within the architectural acoustic studies about the performance space. Italian theatres are characterized by architectural elements, as the orchestra pit, that condition significantly the overall acoustic behavior. The strong reflectivity and the limited dimension of the orchestra pit are responsible of a bigger reverberance and high envelopment instead of focused and dry sound of the stage. The aim of the present work is to integrate the objective characterization of the Teatro Comunale in Bologna with a perceptive evaluation of its acoustics. For this reason, a MIMO auralisation of the theater was carried out by following the recent studies as guide- lines (Vigeant et al., 2011). The followed procedure to achieve the MIMO auralisation consisted on three stages: first a plentiful measurement campaign was carried out, then a rigorous calibration of the computer model was done and finally the convolution of multiple anechoic recordings with multiple simulated BRIRs gave the expected auralisations. The measurements allowed to collect a large variety of results, due to the possibility to measure the theater for different configurations. Thus an accurate calibration of the computer model carried out, considering the staging of the theater and more. Once the binaural impulse responses of the theater were created, the MIMO auralisations was done by adopting multichannel anechoic recordings from Italian Operas (as Verdi, Puccini and Donizetti) which were created by the acoustic group of the University of Bologna. The results of the MIMO auralisations in two different listening positions will be performed on live.

h 12:50–14:00 Lunch
(Editorial meeting for Journal of Temporal Design)

h. 14:00–14:30 Keynote 4
Low frequency noise: an overview of laboratory investigations on human perception and building acoustics measurements

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Protection against noise in general is a basic requirement of the EU environmental legislation as well as of the regulations for building products. The EU regulation No 305/2011 lists "protection against noise" as one of the seven basic requirements for construction works, saying "The construction works must be designed and built in such a way that noise perceived by occupants or people nearby is kept to a level that will not threaten their health and will allow them to sleep, rest and work in satisfactory conditions." This includes all frequencies which can contribute to impact on humans. Low frequency noise (<100 Hz) is particularly harmful since, on one hand, it propagates over long distances outdoors and, on the other, it coincides with poor sound insulation in buildings. Main effects caused by noise, in particular at low frequencies, are temporal and permanent threshold shifts, pressure in the ear, impaired task performance and sleep disturbance. Currently, human

perception is almost exclusively regarded in terms of selected equal-loudness contours, which are highly controversial at low frequencies since levels below the hearing threshold can also provoke reactions. In this context, indoor working and living environments are even increasingly exposed to low frequency noise sources: wind farms, heat pumps, road and air traffic are just some examples. Human perception at low frequency is also mainly affected by low-frequency resonance modes, which entail many problems for acoustic comfort or quality of listening, especially in recording studios, small concert halls or open-space offices. In building acoustics, noise below 100 Hz has been more or less neglected up to now, because the established measurement methods for sound insulation require smooth sound fields, which don't exist in laboratory rooms or ordinary dwellings at such low frequencies, which are controlled by modal acoustic fields. Thus standard measurements are not suitable and accurate enough in order to achieve repeatable and reproducible measurements in the low-frequency range (50–100 Hz). Typically, building acoustics measurements (airborne sound insulation, impact sound insulation and reverberation times) lead to unacceptable high uncertainties when applied to frequencies below 100 Hz. In this work a summary of laboratory measurement campaigns performed in the last years at INRIM on low frequency noise is presented. In particular it is shown that low-frequency noise produces cognitive and physiological effects comparable to broadband noise and that the well-known relationship between noise conditions and effects on human health requires the development of a proper metrological procedure to evaluate the stress due to acoustical factors. At the same time, new approaches for building acoustics measurements at low frequencies (airborne and impact sound insulation and reverberation time) have been developed and proposed in order to improve the accuracy and the precision of the standard measurement methods for the acoustic characterization of buildings and building elements, with promising results.

h. 14:30–16:10 Oral Session 6
MEASUREMENT, PERCEPTION AND CONTROL AT LOW FREQUENCIES

chair: Andrea Prato
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Measurement of reverberation times against modal decay times in an empty bedroom

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Reverberation time in small rooms is an ephemeral concept. We know that the presence of standing waves with their own specific modal decay actually regulates the LF band RT values. This phenomenon impose an higher measurement uncertainty due to sound energy spatial distribution. A different approach is to be found to characterize LF decay behaviour. The authors used an empty small bedroom to extensively measure reverberation time with a direct (clapper) and an indirect (logarithmic sine-sweep) method (ISO 3382 and ISO 18233). The low frequency RT results will be discussed against modal decay times, these last were measured through the impulse response using the AQT2 method and also through the direct measurement of pure interrupted sine bursts. The results are discussed.

Low Frequency Analysis for recording studio design

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As everyone knows, the most important problems to be solved in a control room, and in recording studios in general, are related to low frequencies. In general, we are all used to seeing reverberation time charts in 1/3–octave bands, but if we could evaluate the modal decay times (MT60, reverberation of a single mode) at LFs we would notice that these perfectly determine the reverberation times. At low frequencies you cannot use statistics. To put it in physical terms the field is 'quantised' – in

other words, the resonances are mostly isolated and distinguishable. Nowadays FEM (Finite Element Method) software is common and can be used to see the room modal resonances, to simulate the interaction of a sound source with the room, the frequency response at the listening point(s) and the absorber performances. FEM software is a truly valuable tool for acoustic design. It provides considerable support to designers on a part of the spectrum range (LF) that we could not have much certainty on until now unless you precisely adopt a predetermined design that you know works from trial-and-error. The major innovation is that with these simulation methods you can build rooms with a good listening experience in unconventional situations while also studying alternatives and innovative acoustic treatments. Ill show some results of FEM analysis for recording studio design. The first results from a control room FEM analysis are the effects of flushmounting the main monitors. Another interesting thing to show is that you can not quantify the absorption if you do not know the position of the absorber with respect to room resonances. The last study refers to the standing waves distribution in the room making a comparison between an "optimal dimensions" (Louden) room with another one of identical size where the side walls are slanted in a x–axis symmetrical way.

FDTD simulation of room acoustics: recent developments and application to auralisation of Italian opera house

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Sound propagation within concert halls and opera houses is generally governed by wave phenomena; yet currently, most simulation techniques for room acoustics are based on the simplifications of geometrical acoustics, wherein sound is assumed to propagate along rays or via particles, leaving wave diffraction effects largely neglected. Such simplifications have traditionally been motivated by perceptual considerations relating to statistical acoustics, but have also been employed out of necessity, since limitations in available compute power had, for some time, precluded the direct simulation of sound waves in large spaces. Today, thanks to advances in computing hardware, it is becoming increasingly possible to employ wave-based simulation for auralisation purposes, allowing one to abandon geometrical and statistical simplifications, and capture all relevant acoustical details of a space (in theory). Among others, one popular wave-based technique, the finite difference time domain (FDTD) method, has recently shown promise in being able to simulate large spaces at audio rates by exploiting special-purpose computer graphics hardware. However, the application of time-domain wave-based methods is not only a question of computational costssuch methods carry additional complications in terms of algorithm design, mainly to ensure that resulting numerical solutions do not experience exponential growth (numerical instability) and converge towards the correct solution of the model problem. This talk will give a brief overview of FDTD methods in the context of room acoustics simulation, and present recent developments that have resulted from the five-year ERC-funded NESS (NExt generation Sound Synthesis) project, including modelling of arbitrary geometries, variable and frequency-dependent wall conditions, and viscothermal effects in air. As an application of these developments, preliminary wave-based simulations of an Italian opera house, based on architectural models of DOrazio et al., will be presented.

Designing for Stability in Low-Frequency Loudspeaker Drivers

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Recent research on the nonlinear behavior of loudspeaker drivers has shown that the dynamic instability above the resonance frequency is intrinsic to the motor structure of the moving coil loudspeaker. The paper will review both the linear model of the loudspeaker, emphasizing the links with the harmonic oscillator, and the main nonlinear phenomena relevant to cone drivers. For a given loudspeaker driver, model-based simulations can be used to assess the amount of DC offset caused by the instability, and to evaluate the advantages and disadvantages of several possible design strategies. The paper will show the results of simulations in the time domain and the impact of engineering choices on the technical specifications of the driver.

Several Characteristics of film speakers

Ken Ito[1], Akinori Takei[1] and Shigekazu Ishihara[2]

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We have measured acoustic characteristics of laud speakers in film form at both cased of normal magnetic dynamic speaker and non–magnetic piezo-electronic polymer, and found extended time–correlation in both cases.

h. 16:10–16:30 Break – Poster Session: Student Design Competition

h. 16:30–18:30 Special Session
PERFORMANCE SPACES

chair: Linda Parati
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The UniCredit Pavillon

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UniCredit Pavilion (arch.: Michele De Lucchi), opened in July 2015, has been designed with great attention to environmental sustainability and has been built using natural materials and innovative building techniques. The building makes a connection between Gae Aulenti Square and the UniCredit towers. The tight structure made by larch and the lightness of the glass create a suggestive environment. The peculiar geometry of the building suggested a bearing structure with columns, beams and pillars made of lamellar wood, in order to an adequate aesthetic value of the outside. The transparency inspired the work: a shadowing system fixed to the wooden structure is placed outside of the glass facade, in order to regulate the light inside of the space. The choice of a building made of wood and glass gives the space a sense of protection, at the same time allowing the visibility of the interior. The building contains an auditorium on the first floor - a large and modular space - a suspended boardwalk on the first floor - to host expositions - a greenhouse on the top of the building - a bright open space - and finally the "Mini Tree" nursery. The auditorium has 700 seats. The hall may be also split into several independent rooms operating at the same time.

ReS, Resonant String Shell, latest development in the design of an acoustic shell for outdoor concerts

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ReS is a sustainable hand-built temporary acoustic shell, developed since 2011 and built during the architectural workshop at Villa Pennisi in Musica in Acireale, Sicily, each year since 2012. The design concept aims at providing a portable structure by reducing the on-site construction problems and the skills required by the builders together with maximizing the acoustic performance for the audience and the mutual listening of the musicians. The shell is built using only wood, recycled

mostly, and can be built and dismantled by non- specialized workers in just 3 days. The original concept for ReS was developed from the silhouette of old fashioned gramophones, able to amplify and project the sound uniformly to the audience, that has been refreshed by the used of carefully designed elements (panel arrays). The shapes of the main shell and of the panel arrays are calculated by a proprietary optimization algorithm developed in Grasshopper, environment in Rhino for parametric design, which is designed to optimise the acoustic response on a defined audience area based on basic geometrical acoustic principles. Three fundamental purposes have been investigated to better perform open-air concerts with ReS: 1. To generate a uniform sound field to the musicians, improving the ensemble and reducing any frequency-cancelation event or comb-filtering; 2. To increase the sound loudness and clarity on the audience; 3. To enhance spatial perception and apparent source width. The results are then verified in a more advanced acoustic modelling environment (Olive Tree Lab). This paper describes the research and design process, which spans over 6 years now, and present the final results in form of acoustic simulations, by the help of the Olive Tree Lab suite, and real world measurements, including directional impulse response measurements processed with the Spatial Decomposition method developed at the Aalto University in Finland.

A restoration based on the result of a public debate: the case of Civic Theatre of Schio

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The Civic Theatre of Schio is an important case study of refurbishment of an historical opera house. The theatre was designed and built with all the features of the Italian theatre. The area for the public is composed by the audience, two orders and a gallery. The construction began in the summer of 1907 and the theatre was opened in June 1909. The design of the restoration has been based on the result of a public debate: the Lotto Zero" project. In 2005 a work group composed by many people from different areas, as architecture, technology, direction, and also by a group of audience and citizens, discussed about the approach to the refurbishment of the theatre. People were involved in compiling questionnaires after the participation of a program of events organized in order to test the Theatre. The renovation is yet uncompleted, nevertheless the Civic Theatre has been reopened in 2014 and it is used for music and prose. The present work aims to characterize the restoration by using the acoustic analysis of the hall. Measurements have been done in 2015 September according to ISO 3882 and literature. Measurements have been performed in an unoccupied condition, without wings or other curtains, in order to compare the results with the ones measured before the refurbishment, during the debate of "Lotto Zero". Acoustic characterization allowed to compare measurements performed before and after the restoration. This comparison has made possible a reflection on solutions and materials selected in the refurbishment. Results of acoustic qualification show also some peculiarities of the restoration and, more in general, the potentiality of a partecipate discussion over the theatrical fruition. The Civic Theatre of Schio is therefore an interesting case study due to its particular partecipate renovation and to the choices done during restoration works. This kind of approaches has made it original among other Italian theatre. Moreover, the analysis on the Civic Theatre leads to a more general reflection on Veneto theatres. The availability of previous analysis on various theatres of Veneto, such as the theatres of the cities of Adria, Rovigo, Treviso and Venezia, in fact, has allowed to make comparisons between different Veneto theatres.

A survey of music venues and eating establishment designed in Bologna, UNESCO Creative City of Music

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In 2006 Bologna has been declared UNESCO Creative City of Music, a prestigious award that celebrates its rich musical tradition and its current lively scenery. In addition to the main institutions, such as Teatro Comunale, UNESCO has recognized the spread creative scene that Bologna provides in music production and fruition through a frequent and extensive cultural offer. The whole range of festivals worthy of international importance goes from classical and contemporary music seasons to jazz sessions, song–writing and emergent music, often played in small clubs managed by cultural associations. Bologna is also popular for its gastronomy and its wines quality, thereby this aspect is increasingly becoming more attractive to international tourists. The acoustic consultants aim and responsibilities are in line with this scenerys needs; indeed, in aesthetic and functional refurbishments within restaurants and music clubs the key role played by the acoustic comfort frequently is not taken into account ignoring the quality of the experience, whether culinary or musical. The interventions intended to improve the acoustic comfort can be simple and poorly invasive from the aesthetic, structural and economical points of view. Those interventions aim to increase the rooms potentialities and to reduce the global noise produced, bringing benefits both to the owners and to the community. The paper is about some case histories realized by DAS studio on the occasion of functional renovation of different types of rooms inserted in Bologna urban context: 1) a private club realized for live music that reminds a 70s recording studio. For the acoustic correction custom absorption grating diffusers have been realized, designed and installed according with a University of Salford research. 2) a private club for live music sited in an urban regeneration context, behind the high speed train station. The whole club, which is on the ground floor of a residential building, has been acoustically insulated from the adjacent rooms, while inside the hall intended for musical entertainments an acoustic improvement intervention has been designed with particular efficiency at low frequencies. 3) a pub-brewery where the intervention has been conceived in order to improve the inner room acoustics and has been realized with sound absorbing material and metallic coverings, in line with the club furniture style.

The Italian Technical Standard UNI 11532

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The UNI 11532 is going to be a package of standards; it will be composed by a common part where the fundamental acoustical aspects, such as parameters, prediction methods and verification methods will be explained and several subsequent parts where specific goals will be refined. The first specific part is dedicated to educational buildings: the goal is to achieve a good speech intelligibility; the end users will be: teachers (vocal effort reduced) and students (attention encouraged). The main tasks are three: Reverberation Time (RT), STI (Speech Transmission Index) and background noise. The suitable values for RT will be those listed in the DIN 18041/2016, where values depend on speech or music activities and geometrical aspects. STI will be referred to the BB93: acoustic design of schools - performance standards and the UNI technical committees experiences. The background noise is a complicate issue in educational buildings. Basically it can be defined as "all the other signals (noise) different from the one of interest". In literature few information is given, such as the Student Activity Noise (Hodgson et al., JASA 1999) in which background noise is due to environmental noise (external noise), students behavior, and installations' noise. Background noise is one of the most important factor for speech intelligibility. As a matter of fact the STI depends on the signal to noise ratio. Here is the main point: the UNI 11532 standard will be the reference document for public tenders and thus everything in it must be clear, predictable and measurable. On the other hand, installations' noise is the only predictable aspect of background noise. What seems to be the best way to solve the problem is to consider the teacher's vocal effort as Normal (based on ANSI 3.5, i.e. having L_{eq} equal to 59,5 dBA at 1 m), and design the room so that, thanks to the reverberation time and installations' noise, a suitable STI value can be expected. This procedure will allow carrying out measurements following ISO 3382, and the STI will be objectively assessed in unoccupied conditions. By means of a given transfer function, based on reference sound absorption of people and furniture, applied to the measurement results, the STI value will be estimated in occupied conditions too. The other specific parts of the standard will be dedicated to spaces like open plan offices, restaurants, etc. where the well-known phenomenon called Lombard effect is dominant, i.e. where people raise their voice, and the vocal effort, in order to stand above the "background noise" produced by their own voices. At the end, the real goal pursued in the standard is to provide objective criteria for better responding to the need of acoustical comfort in daily life.

Improving the intelligibility of a heritage-constrained university room using both acoustic treatment and line arrays

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In May 2017 the Literature and Philosophy Faculty of Bologna University became interested in solving the acoustic matter inside a classroom that is supposed to be a multimedia center for a course named Digital Humanities. It is an historical and constrained classroom, named Aula Affreschi because of its valuable frescoed vault. The reasons behind the intention of an acoustic treatment are all the complaints from professors and students concerning the vocal effort and the lack of an appropriate speech intelligibility. The aim is to create the ideal conditions in which professors should be able to effortlessly teach and students should understand the speech even without using the public address system. In order to characterize the current status of the case study a campaign of acoustic measurements has been carried out focusing on the quality of speech intelligibility throughout the space. Measurements have been performed with the presence of furniture and in unoccupied state, using an omnidirectional dodecahedron as sound source, according to technical standards. Background noise, which has been revealed by a sound level meter while the air conditioning system was turned on, has served to precisely determine the Speech Transmission Index STI. In order to design the intervention works, a virtual 3D model has been realized and then calibrated by means of an acoustic simulation software based on hybrid ray tracing algorithms. The aim of the work is a proper balance between the passive acoustics requirements and the need of special loudspeakers. First of all, some passive acoustic elements have been introduced: 17 vertical baffles and a light transparent reflecting panel have played a key role respectively in reducing the reverberation time and strengthening the early reflections without ever being invasive, expensive or inappropriate in relation to the cultural heritage worth of this place. Given the historical importance and value of the hall, any structural or substantial modifications was supposed to be avoided and frescoes on ceilings had to be kept and preserved. As public address system, line arrays have been chosen because of their cylindrical sound waves that weaken much less than the spherical ones, ensuring a homogeneous distribution of the sound pressure level and STI parameter. Furthermore, line arrays directivity is specifically designed to guide the sound towards a quite narrow angular opening. In this way, with the right height and positions studied for the loudspeakers, the public address system operates only where its needed, namely on the students desks, instead of spreading the sound wave towards the vault that could cause harmful acoustic effects. Results gained by the acoustic simulation of the intervention have shown that already the passive acoustics actions were enough to increase the speech intelligibility in all the receiver points, but only introducing line arrays system the target value of 0,6 for STI parameter can be obtained. Test measures conducted after the realization of the whole intervention have confirmed the achievement of satisfying values in each row. Moreover, line arrays ensure a decrease of student distraction owing to the fact that they just amplify in a more natural way the professor voice, reducing his vocal effort, too.

18:30 Closing Ceremony

19:00 Pre-dinner and live music

NERO Factory
Vicolo Broglio 1/F

5 Student Design Competition

Preserving memory: the reclamation project for the old Cinema Savoia in San Giacomo delle Segnate

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We are surrounded by ghostly places and abandoned locations that we ignore most of the times. All these buildings are characterized by their own personal history. I was really attracted by old cinemas, that laid alone without any references to their past nor any prospective for their future. After analyzing about sixty of them, all located in the middle of the Po valley, we understood that the shape is one of the biggest problem for this type of buildings because is the shape itself that influences the clarity of the speaking. Sometimes the structures of an old theater were adapted to screen movies, but more often a new building was erected to serve exclusively as a cinema. In this case, the structures become high, narrow because they should not be recognized among the other buildings and the space available was limited by the surrounding constructions. For these buildings, the right shape could be absolutely determinant for the proper comprehension of movies and conferences. We first catalogued these structures with the aim of analyzing their shapes, their interiors and their positions in the city. Then we selected just one to make an architectural and acoustic reclamation project: the Savoia cinema in San Giacomo delle Segnate. We decided to maintain the structure and the buildings shape; after all it would just be necessary to replace the old materials with more performing ones. It was important to reproduce the same conditions of the old cinema, putting only one sound source behind the screen and trying to diffuse the sound and uniformly distribute the energy in the theatre, as opposed to todays Multiscreen, where the quantity of absorbent materials created a dead ambient, without any reflection. For this reason, in multiscreen more sounds sources were introduced to let the sound being heard also in the last row. This would be the right approach with this kind of structures that we found all around us, in the middle of the Po valley. A few small interventions could foster the renaissance of a myth of the last century, the cinema.

Study of comfort level of historical heating system and development of not invasive systems for the improvement of the comfort level of existing dwellings

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The objective of the study is to analyze the technical solutions for improving the comfort of residential dwellings, intervening on existing heating systems without the need of a complete overhaul, for example where the installation of a radiant floor is not economically feasible. With these techniques, we try to return to the historical concept of the chimney, redefined as the focal point of the space, recreating and actualizing its role and conditioning the layout of the space. By using Design Builder software, a historical space with a chimney was numerically modelled in order to determine the apparent temperature. This model confirmed the reported discomfort due to low performances of fireplaces and uninsulated walls, validating the need for arrangements such as screens, fire screen desks, air circulation lamps, which historically marked introduction of the comfort concept, also known as wellness. Afterwards, we modeled the further development of the heating system techniques: the radiator made up of tubes with overheated air, steam or water, which spread from 20th century and has evolved as the radiator as we know it today and finally as the radiant floor panels. Through CFD simulations it has been validated that this last heating system is the most effective, since it is able to spread heat more uniformly and thus to create a best sense of comfort than the radiator, which, being a concentrated heating system, focuses the comfort area on an area surrounding itself. However, it is not always possible to install a radiant floor, both for historic buildings and existing dwellings. Therefore, we have performed CFD simulations in order to define a technical solution that maximizes he comfort of dwellings where a radiant floor cannot be installed. We have taken into account two types of residential dwellings: the perfectly insulated ones, which fall within the limits of thermal insulation standards, and the not insulated ones. We have modelled

the installation of radiators with lower water delivery temperature and a bigger size compared to traditional one in order to recreate the feeling of comfort of the radiant panels, within the limits provided by the UNI EN ISO 7730 standard. Different simulations have also been performed based on clothing and activities factors that considerably influence heat perception and thus shape the need for a more or less heated dwelling. Moreover, air recirculation fans have been added to the numerical model, since they could spread more uniformly the heat produced by the heating system placed in a point of the room, allowing to reach the best levels of comfort. Preliminary results show the success of this solution in thermally isolated homes, achieving optimal comfort levels, while for uninsulated cases the performance is lower but still its ensures a level within the limits defined by the standard.

Composite technology for an innovative students pavilion: energy, daylight analysis and a new concept of sustainability

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The present research investigates an innovative use of fiber reinforced composite materials (FRP) in the building industry and develops a construction system that has the potential to fuse structural, energy and architectural performances in one single light, resistant and efficient shell element, with systems integrated inside it. This gives the opportunity to deal with the concept of sustainability in a broader sense, changing the point of view from assessment protocols based on checklists to the idea of integration and inter-dependence of different aspects. The aforementioned concepts are applied to the design of a University students pavilion: its energy and daylight performances are analyzed through computer simulations, while a 1:2 scale prototype of a pavilion portion is fabricated to test the material characteristics. The construction system consists of a continuous, double curvature FRP sandwich shell: the outermost layer is a carbon FRP, the inner one is a glass FRP, while systems are placed in the gap between the two, together with polyurethane filling. The latter creates a thermal insulating core and separates the two load bearing elements. Potentialities and limitations connected to these materials are discussed, including considerations over the building construction, transportation, energy consumption and overall efficiency. The pavilion is located on top of an existing building, avoiding land consumption and giving new functionality to an unused terrace. Given its position, it is highly exposed to solar radiation: that is why it is designed to maximize daylight autonomy and solar gains in winter, while avoiding glare and minimizing cooling loads in summer. Starting from the early stage of design, energy simulations are carried out and inform the pavilion shape creation. The energy model consists of seven thermal zones, conditioned through a VRF system with heat pump, which is completely autonomous from the existing building. The system serves the pavilion when needed, thanks to a series of sensors; moreover, air temperature can be locally customized, creating a heterogeneous environment where users can perform differentiated activities, depending on their position and comfort preferences. Air, radiant and operative temperatures are evaluated for different periods of the year and results are displayed on maps. Mechanical ventilation is based on occupancy and assures compliance with air quality regulations. The summer season is found to be the most critical period for energy consumption, so a ventilation system is developed to refrigerate during the night. Software integration is a key factor in this process of extreme integration of different functions. Energy and daylight simulations are based on Energy Plus, Daysim, Radiance and the plug-in Honeybee, which allows an easy connection with the 3D modelling software Rhinoceros, through the scripting platform Grasshopper. Opportunities, limitations and possible future improvements are also discussed.

Maurizio Sacripanti's "Theater in Motion" (1964–1965). The Organization of Time and Space

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Maurizio Sacripanti (1916–1996) was a roman architect whose work is - sadly - still not widely known. His visionary and eclectic works reached their highest peak when it comes to his projects for

theaters. In particular, Sacripanti took part of the competition for the Cagliari Opera House (1964–1965), with a project called Theater in Motion, also known with the appellative of "Total Theater", directly linked to Walter Gropiuss proposal of 1927. In his proposal, Sacripanti suggests a theater made of prismatic elements shaping stalls, stage and ceiling - which can be lifted and lowered through electroning programming, thus defining endless definitions of space, acoustics and lighting, according to the different performances which a theater can host. Fernando Tvoras words on the "organisation of space" [5] and what Bruno Zevi called "the sixth invariant of modern language: the temporal space" [6] intersect in Sacripantis approach to theater architecture: as a matter of fact, Sacripantis attempt is to go beyond a finished architectural episode, including the fourth dimension both time and motion - into the design process, through technology and electronic devices. As the fathers of electronic music were working on aleatoric compositions from John Cages "The Music of Changes" to Karlheinz Stockhausens "Klavierstcke" – Maurizio Sacripanti suggests an aleatoric kind of architecture, which is discrete, potentially infinite in its reconfigurations of stalls and stage. Moreover, Sacripantis work cannot be separated from Antonin Artauds scenic avant-garde proposals, which longed for the theater as a "one space, without divisions or barriers" [7] , and from the experiments by Peter Blake, David Hays, Alain Bourbonnais and Jerzy Grotowski. Sadly doomed to paper, this visionary design was, in Sacripantis words, a way to overcome the disappointing space of a traditional stage, in order to host avant-gard performances such as "Cages ballet, with sets and costumes by Rauschenberg" [8]. This paper aims to go through Sacripantis design method and understand how much of his legacy can still be found in theaters today, in order to foster more detailed studies on acoustics and lighting possibilities of adaptive and reconfigurable architectures such as the ones imagined by the roman architect.

Improving working comfort in an open plan office

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Over the last few decades, thanks to the large-scale diffusion of technology and IT systems, and through an increasingly global economy, the society is experiencing a moment of change and people are welcoming it as an opportunity to follow new styles of life and, consequently, of work. The working day, which was only a few years ago ordered by fixed hours and bound to the office location, follows today's dynamics and modes that are clearly distinct from the past. The relationship between man and work, and hence between man and office, is re-evaluated: the increase in mobility and the variety of media allow for unprecedented relationships, and lies ahead of the need to redefine work models to develop new ones space solutions. The typology of open space office, that has been widespread for its optimization and flexibility of the environments, has turned out to be inadequate to ensure the tranquility, silence and privacy that people need to do their business. The constant exposure to phone calls, speeches and other tales, coupled with visual distraction caused by the lack of walls and separations, causes stress and significant concentration disorders. The strength of the new models, which are gradually being established in our Country, is the consideration of all the many aspects concerning the execution of a job: organization, trade, support, habits and space; the individual is at the heart of the trading network and moves by following intelligent ways of work, that take the name of Smart Working. This paper proposes the upgrading of some open-plan offices, in line with new work models, in which architecture and acoustics play a key role. The inadequacy of internal partitions and the overcoming of past work-based environments, is followed by an analysis of the spaces and the internal paths, together with interviews to understand the needs and interactions between the working groups. Finally, comes the proposal for new layouts. Likewise, as a result of the many acoustic problems and lack of privacy, the main causes of noise that characterize open spaces and deepen acoustic behavior in an office are investigated through timely surveys.

Podestá Hall: a sound renovation

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[5] F. Tvora, Lorganizzazione dello spazio, in A. Esposito, G. Leoni (a cura di), Fernando Tavora: opera completa, Milano, Electa, 2005, pp. 314–317.
[6] B. Zevi, Il linguaggio moderno dellarchitettura, Torino, Einaudi, 1973, p. 53. (in Italian)
[7] A. Artaud, Il teatro e il suo doppio, Torino, Einaudi, 1978, p. 211. (in Italian)
[8] M. Sacripanti, Cittá di frontiera, Roma, Bulzoni, 1973, p.22. (in Italian)

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The architectural complex composed by the Palace of the Podest, Re Enzo and the Capitano is located in one of the most appreciated squares of Italy and own an ancient past. Currently, however, its environments are not accessible to the public, except during special occasions such as food and wine festivals, congresses and cultural initiatives, mainly concentrated in the Podest Hall, the largest and most luxurious of the complex. In spite of its natural, historical predisposition to aggregation, being the first fulcrum of the administrative and legal life of the city of Bologna, during the aforementioned events, one of the great problems is the leak of a sufficient acoustic in the Hall. Hence the idea to design an appropriate solution to make one of the most prestigious and refined environments in the city, a place of better communication, culture and entertainment. It is no coincidence that this is part of a broader analysis, conducted in collaboration with another student, who connected the improvement of the acoustic aspect with the accessibility and enjoyment of the spaces for the audiences. To design the public opening, the respect for disabled and the compliance with the current fire regulations. To carry out such a project can not be ignored the historical research, aimed at the knowledge of the building, its evolution and its constituent materials, which then necessarily follows a careful analysis of the acoustic behavior of the exhibition so that it recognizes it criticality and potentiality. This approach produced a twofold outcome: the formulation of intervention in the respect of the historicity of the environment and the acquisition of acoustic data through a methodical and objective process.

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