

# XTREME Recital

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## Abstract



*XTREME RECITAL* is a multimedia show inspired by the *XTREME Life in Extreme Environments* exhibition (ESOF 2020 - Trieste, Aug 29<sup>th</sup> - Oct 11<sup>th</sup>, 2020). Our production stems from reasoning about human conditions in the extreme environment of Antarctica, and attempts to answer the question of who we become, visiting a harsh reality where our sins, dreams and senses, are heading to the better part of ourselves. By collecting word and visual documentation, natural sounds and related poeties are exploited to explore the striving emotional impact of life in such extreme condition. Four

independent composers are invited to write original works for piano, cello and electronics which, by means of innovative and compelling techniques, aim at facing with the conflict between Man and Nature and conceptualize, through the music, a possible solution. The harmonies of *Des Pas sur la Neige* by Debussy is the starting point for suggesting a unifying emotional atmosphere that is set up by the composers through relationships between concrete natural sounds and instrumental human gestures, research on remote perception, and generative algorithmic structuring. Using a minimalistic theatre approach, two actors join the musicians with dialogues inspired by the subject of the exhibition and an original choreography. The use of interactive technologies finally enhances the amalgam between all performers and the environment made of sounds and gestures, achieving a performance each element of which takes the form of a living dialogue.

## 1. Introduction

*XTREME RECITAL* is a multimedia show inspired by the *XTREME - Life in Extreme Environments* exhibit [1], which took place in Trieste from 28 August to 11 October 2020 and was part of the

activities of Science in The City - ESOF 2020. Partners of the exhibition were the Italian Institute of Astrophysics (INAF), the National Antarctic Museum, the Regional Speleological Federation - Friuli Venezia Giulia, the University of Trieste, under the patronage of the European Astrobiology Institute and the Italian Society of Astrobiology. In a follow-on multimedia project, a group of scientists, musicians and actors collectively designed and shaped a multilevel performance in which natural sciences, music, theatre and interactive systems blend together in an innovative way. As pointed out by Oscar Schlemmer, cofounder of the Bauhaus School: "The stage is the arena for successive and transient action" - a main space for the dynamic confrontation of different artistic approaches and the living evaluation of theories and relationships [2]. Placing itself within the vast panorama of interactive artistic production in which creation, performance, perception and action develop on a common level and nourish each other on their respective contents, our project takes inspiration from concrete natural phenomena to achieve a new form of synthesis between science, humanities and art. What do Speleology, Antarctica and Astrobiology, three apparently distant contexts connected by the extraordinary resilience of life in extreme conditions, have in common? What sensorial and emotional experiences impact a human being venturing inside such extreme environments? How do modern technologies - be they concrete music, multimodal gesture interaction, or algorithmic composition - lend themselves to creating a scenario suitable for effectively communicating such a message? Our research project

attempts to address these questions by combining scientific knowledge, stage direction, music performance, poetry, dance, and multimedia interactive technology to create a unique space of cognitive confrontation.

## **2. The XTREME Project**

### **2.1 Scientific context**

The purpose of the EXTREME exhibition was to illustrate the main features of extreme environments and the conditions for life to thrive in hostile habitats, as well as for our species to adapt. It presented to the public the strong connections between Antarctic, Speleological and Astrobiological research, usually told as disciplines in their own right and not as three forms of exploration with partially overlapping purposes, methods and history. Topics included survival technologies spinning out from Antarctic research (Fig. 1) to space exploration, plans for underground space colonies on Mars or on the Moon, and the search of extremophiles on Earth - the very special organisms living deep and dark underground who can shine a light on the extra-terrestrial life that maybe, one day, we will meet. In the exhibit, the audience could compare the history of the Antarctic and speleological explorations, as well as ancient and modern iconographies of Antarctica, Speleology and extra-terrestrial environments. Those present were able to learn that the cryosphere and the underground environment, despite being terrestrial, offer good prototypes for the exploration of Mars, the Moon and the icy satellites of our giant planets - such as Enceladus on Saturn or Europa on Jupiter. By taking a look at the ways humans devised to survive in those environments, participants could finally

face the problem of extreme survival and exploration.



Figure 1. XTREME exhibition, Antarctica.

## 2.2 The performance

Inspired by one of the themes of the exhibition, our performance starts from the analysis of scientific and historic documentation, as well as from the direct experience of one of us, to develop metaphorically the interaction between the Human and the Nature in *Antarctica*. Using a minimalistic theatre approach, the four performers - two musicians and two actors - create a symbolic space on the stage where any movement, musical sound or pronounced words form a unique amalgam of artwork that reproduces and mimics human survival in such an extreme environment. Through interpretation and readjustment of Samuel Taylor Coleridge's *Rime of the Ancient Marine* and acting of some excerpts from Giacomo Leopardi's *La ginestra*, we study how the Human changes in such an imaginary journey where - on a stage dressed in a white cover and equipped with a glass of water with ice - we try to answer the question who we become, visiting a harsh reality where our sins, dreams and senses are heading to the better part of ourselves.

Music performance equally develops the theme of interaction between the Human and the Nature through a set of musical miniatures, specifically composed for this project and performed here for the first time. The main source of inspiration is the Debussy Prelude *Des pas sur la neige*, a complete performance of which will be presented at the beginning of the show. "A leaden, grey, sunless sky looms over a scene made all the more gloomy by a thick blanket of snow. Over the snow a solitary traveller tiredly drags his steps, while a poignant song of pain and sorrow is heard, seeming at times to break off in a strangled sob" [3]. This song expresses heartfelt compassion for the desolate melancholy of the snowy scene, and recalls at the same time the lament of a traveller who treads with heavy steps towards his death.

Each miniature of the suite is a reminiscence of the Debussy Prelude, be it an elaboration of the musical material – a rhythmically constant ostinato evoking the underlying impression, combined with a melodic line carrying its emotional substance - or a paraphrase of the evoked atmosphere and meaning. Compositions have been dedicated to the two musicians involved in the project, the pianist Erica Bisesi and the cellist Nicola Baroni, as well as to the whole XTREME Ensemble.

*U são as neves d'antão?* Taking up the theme of a fifteenth-century ballad by Francois Villon, an elegy on the passing time, **Mauricio Dottori** conceived his piece starting from his own experience as a geologist. Getting inspired by the sensorial experience of exiting the tunnel of a deep mine and in analogy to the current pandemic situation, this delicate and expressive piece for cello and piano -

a cry to escaping beauty - evokes the atmosphere of a world that slowly heats up and melts.

The composition takes reference to the "footsteps" outlined in the Debussy Prelude, devising a snow landscape that shows up after coming out of a cave. From this piece, Dottori takes the first two chords and a rhythmic cell. But unlike Debussy who, albeit in a non-conventional perspective, retains some references to tonality, he conceives such elements as mathematical sets subjected to serial operations relating them according to infinite possibilities. In other words, although the musical source material is less abundant than that in Debussy, mutual relationships between different elements are far more numerous. From a timbric point of view, the amalgam between the two instruments is intensified by crawling the piano strings with the bow. This technique also enables production of deeper, full-bodied - almost abysmal - sounds, as a metaphor for the evoked scenario.

The poetic idea of **Marcela Pavia's** *Antarctica* is that all living beings, be they humans or animals, when dealing with extreme situations, reveal their deepest nature. Such extreme situations dissolve the layers of human "civilization", making primordial emotions from the limbic system come to the surface. In a counterpoint of gestures, concrete electronic sounds and obsessive musical figurations, this composition for cello, piano and electronics deals with the theme of the transition from chaos to order as a paradigm of the transformation which affects the Human after confrontation with the limits imposed by the Nature.

The piece begins with purely gestural elements, with a prevalence of electronics. A little at a time, different musical figurations emerge, shaping the electronic sounds. A repeated note stands out, which resolves to an ascending second - a reminiscence, albeit with a totally different meaning, of the generative motif of Debussy's *Des pas sur la neige*. The more chaotic order, or less ordered chaos which characterizes the first part, gradually switches to a more ordered situation. In the first part, the so-called *extended instruments* are employed, i.e. acoustic instruments are played in unconventional ways: pinching of piano strings, producing longitudinal glissandi with the cello, etc. These techniques return very special and unusual sounds, which are combined with the electronics to evoke the requested atmosphere. Electronics is made of concrete sounds (whales, snow footsteps) and instrumental gestures, which contribute to the processing of the electronic material. In the second part, gesture turns into recurring obsessive figurations, shaped through the spatial movement and dynamical control of the cello by means of an algorithm. Then, such figurations are no longer processed further; they just leave their echoes in the electronic background until its dissolution at the end.

The anchorpoint for the poetic and musical discourse is that, in extreme conditions, all beings are similar to each other in the expression of their emotions because they are closer to the intimate essence of their own nature. As a consequence, extreme situations necessarily lead to transformation. In *Antarctica*, it does not matter whether such a transformation will be positive or negative: the only thing that matters is

that it will inevitably take place, beyond any moral consideration.

Such a contrast is further stressed out in the miniature by **Massimiliano Messieri**, *Il futuro in ogni istante - Fantasy for cello, electronics and piano on Debussy Prelude "Des pas sur la neige"*.

"Writing music for Antarctica could be considered a paradox since, as far as I'm concerned, my knowledge of such an environment is not empirical but only based on documentation. Consequently, when composing my piece I had to be led by imagination, guessing at a human being standing at the centre of Antarctica. To achieve the goal, I looked for pre-existing historicized sound material in assonance with the primeval question: "Why to write?"

Human beings are deleterious for Earth, as they take advantage from it without carrying any respect. However, reality is merciless: the Earth could easily live without humans, but not the other way around. While scientifically proved to be the most intelligent animals in the world, "human beings look to suffer from dementia": men need the Earth with all its elements to survive; however, they are doing their best to suffocate and destroy it. *Il futuro in ogni istante* aims at exacerbating such a paradox through a conflictual interaction between the cello (the Earth) and the piano (the Man).

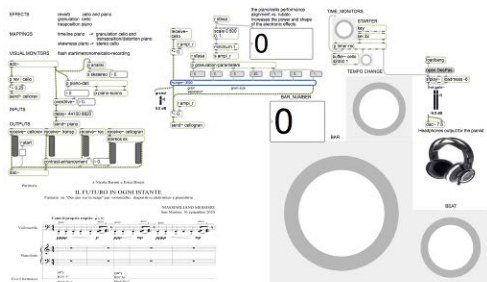
The compositional principle is based on the MMSE (Mini Mental State Examination) test for evaluating the chance of dementia in human beings [4], which is currently adopted by the Italian Society of Gerontology and Geriatrics. The Theme is made of an Antecedent - which corresponds to the musical object, and a Consequent - which represents a

memory of the same. The Development illustrates the relationship between memory and forgetfulness through the ability to remember the musical object. As an Antecedent, a pre-recorded performance by Erica Bisesi of *Des pas sur la neige* has been deprived of some parts, and is re-proposed to the same interpreter who listens to the music on headphones and is asked to perform a memory task: whenever the sound is missing, she has to reproduce her own interpretation by heart. The less accurate she is the more the sound of the cello is deformed. Cello performer is Nicola Baroni, who also developed the patch in Max/MSP (Fig. 2). In the future, we plan to extend the algorithm to include interaction with the emotional body responses, as monitored by sensors' motion capture.

The composition exploits the difficulty in keeping concentration on short and long-term memory during performance action, a task involving multimodal interaction of three senses - hearing, sight and touch - to return an original, science-based interpretation.

Besides scientific aspects, *Il futuro in ogni istante* is a self-standing composition both in its guise for solo cello and live electronics, and for cello, electronic device and piano, where the pianist plays in turn the role of controller of the electronic device. The piece does not admit a unique interpretation, but is open to a multitude of performances depending on the emotional state and mnemonic rendering of the interpreters: whenever exactness will be achieved, the outcome will be identical as that for solo cello and live electronics - as in a classical score where time evolves without any external feedback; but

whenever an action by the pianist occurs, a reaction by the system ensues, that will modify the future of each individual involved in the performance.

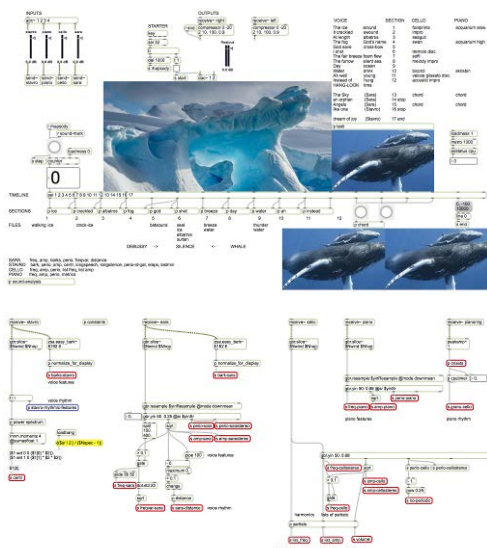


**Figure 2.** *Il futuro in ogni istante*, interactive system by Massimiliano Messieri (software design arrangement by Nicola Baroni). Upper panel: Modules for cello granulation and piano transposition and distortion; monitor and flashing metronome for the cellist. Lower panel: Sound analysis module. The amount of “rubato” in the piano timing affects the electroacoustic response.

The central part of the performance arises as a dramatic trajectory of interactive sound fusion between actors’ voices, the sounds produced by the two

musicians on the stage, and a responsive digital electroacoustic system. The interactive design, which marks this part of the narrative, builds up the musical composition in real time *Crossing Rhapsody* by **Nicola Baroni**: again, a situation of straight conflict between Man and Nature is highlighted. The digital interaction is based on the audio analysis capturing densities, vocal traits and expressiveness of the four performers carrying out the written text and the musical shapes outlined by a timeline (Fig. 3). The performance features, monitored by the digital system, are functional to accentuate electronic processes of intermodulation and fusion between the sounds produced by the live performers, as well as to integrate the relationships between their presence on stage, some selected pre-recorded natural sounds (water, physical alterations in the ice, animals living within extreme climatic environments), and some musical reminiscences live recorded from previously performed pieces. This interactive composition is designed with Max/MSP.

*Crossing Rhapsody* is interactively fed by the actors describing the state of being immersed in an ocean of ice and water, radically distant by any familiar environment: a state of fear, disorder and hostile settings. The music live interaction foregrounds the hallucinatory distance between “household” music and the disrupting concrete sounds of remote natural locations.



**Figure 3.** *Crossing Rhapsody* interactive system by Nicola Baroni. Upper panel: I/O, timeline, sequence of abstractions for the different sound transformations and file triggering, sound analysis module, and poetry cues for music performance alignment. Lower panel: *Crossing Rhapsody* sound analysis module. Piano and cello performance, and the voices of the actors are analysed in real-time in order to extract timbre/frequency features and rhythmic densities/regularities from each performer; these values are then mapped for regulating and modulating the qualities of the electroacoustic outputs.

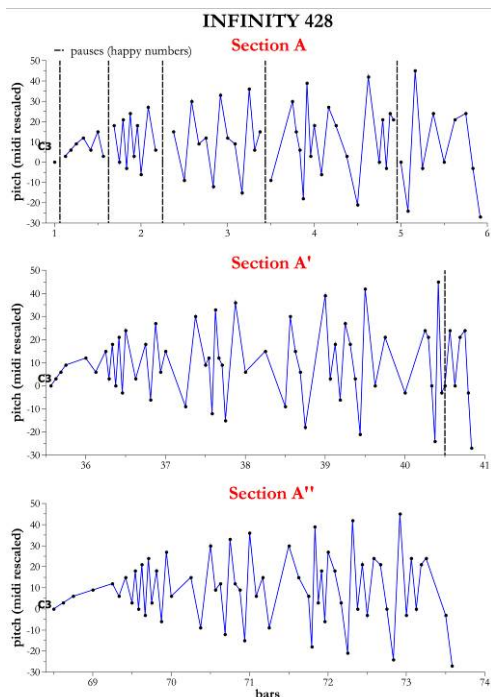
The last miniature, *Infinity 428*, is a piano composition conceived by **Marco Giommoni**, and is based on mathematical models of non-dodecaphonic serial development (Nørgård's series) and other numerical series. It takes advantage of the flexibility and completeness of "Opusmodus", an IT tool and interactive composition environment that allows addressing topics of considerable complexity [5]. The pitch profile is derived from the

development of the first 428 terms of Peer Nørgård's "infinite series": a numerical progression model that applies to the intervals of an arbitrary series of pitches a set of transformations, like inversions and expansions, providing the set an "open hierarchical organization", e.g. a "form" which leads back to fractal geometry [6]. The following two aspects of a same concept of fractal geometry well illustrate such an open hierarchy: self-similarity and scale invariance. The first aspect corresponds to the fact that "micro-structure" can always be traced within "macro-structure"; the second highlights that each structural level is re-proposes several times on a different scale. The starting set for the Nørgård series is a group of 5 pitches belonging to a diminished seventh chord (C - E flat - F sharp - A - C). Rhythmic grouping, on the other hand, arise from the division of a metrical unit (of 1/4) into five different prototypes (of 1, 2, 3, 4 and 6 events each), so as to obtain as many isochronous groups. Once the isochronous groupings are generated, their linear arrangement in a sequence of 428 units occurs for random selection.

The piece is structured into three main sections, followed by a Coda. Each section consists of an identical sequence of pitches with different grouping profiles. Pauses, on their part, contribute to piece segmentation by introducing an appreciable asymmetry between the sections (Fig. 4).

As for the distribution of the pauses, Giommoni uses the series of "happy numbers", defined by the following mathematical formulation: starting with any positive integer, such number is replaced with the sum of the squares of its digits; the process is repeated until we

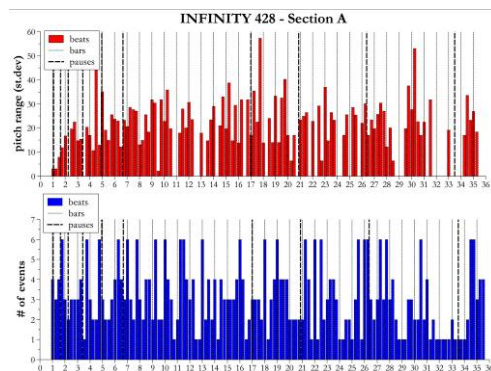
get 1, or we enter a loop that does never include never 1 [7]. The numbers for which such process returns 1 are called *happy numbers*, while those, which never give 1, are *unhappy numbers*. *Infinity 428* takes into account the first 68 happy numbers of the series, i.e. those numbers that are included in the interval [1 – 428]. They identify as many positions where the corresponding pitches are replaced by a pause of equivalent duration.



**Figure 4.** Relationship between note pitch and duration for the first five bars of each of the three main sections of *INFINITY 428* by Marco Giommoni. Note the different grouping profiles and pause density.

The overall result is double: the relatively rigid compactness of the infinite series contrasts with the random distribution of the isochronous rhythmic groups and is, at the same time, segmented by the

pauses (Fig. 5).



**Figure 5.** Pitch range and score event profiles for the first section (bb. 1-35) of *Infinity 428* by Marco Giommoni. Pitches are rescaled to C3 and pitch range is measured as the standard deviation of pitch at each beat.

This results in a molecularized sparkle of sound particles rotating like a mirror around an imaginary centre, which reflect themselves like a gibigiana on reflecting walls - perhaps belonging to imaginary ice caves without a “vertex” and a “bottom” - as well as to the hypothetical “depths of the soul” evoked by Coleridge’s *Rime of the Ancient Mariner*. Perception of such a “sparkling effect” is induced at the same time by wide register changes and alternation of very diverse grouping figurations. By attempting to establish a semantic association, we might relate this effect to synesthetic perception of light reflectance: the higher in case of large register shifts and dense sound granulation, the lower in the opposite case. This reasoning may provide a plausible explanation of the aesthetic evaluation of this piece as provided by some listeners, that is, “a continuous juxtaposition of white and blue”.



### 3. Discussion

The project presented hereby foreshadowed itself as innovative from different points of view. Beyond originality in the overlap of different, sometimes contrasting, approaches to music performance and composition, as well as its intrinsic high degree of interdisciplinary, we expect to provide a significant contribution to the area of interactive performance thanks to a specific synergy between natural sciences, humanities and artistic creation. Indeed, the inspirational theme, i.e. human survival in extreme environments, was not only the subject of the independent scientific study that led to the exhibition; it also offered concrete insights both for music composition and for the theatrical installation. If, on the one side, natural sciences nourish applied sciences - which, in turn, work for the benefit of performance, in a circular process, the theatrical and musical direction - both of which involve artists who are at the same time researchers in natural sciences, is conceived with the precise purpose of communicating, in full compliance with the aesthetic canons, the deeper message of the exhibition.

*Ice and water...* A man lost his way because committed a crime against Nature: an extreme environment and a severe reality. *Alone, alone, all alone...* Such a pure and bright scenery, but so scary and mortal at the same time! How could you survive in a place where only few forms of life can survive? And, if you survive, who you will be? The same person or someone else, a better version of you, capable to sharpen your senses to extreme, your desires to a shout, your feelings to new meanings in your

everyday life? How a person goes beyond his/her limits to survive? Whether we survive because the severe Nature allows us to become a function of Her generosity, it is a quest of finding our own authentic being. When a drop of drinking water becomes your only need in oceans of water and ice... Are you alive? Is that you?

By combining acting and performance of different elaborations of Debussy's Prelude *Des pas sur la neige*, our performance proposes an original resolution to the dialectical contrast between Stepmother and Benign Nature: *La ginestra, o il fiore del deserto*, lives in desolate places without surrendering to the force of Nature, and resembles to an ideal man who rejects any illusions about himself and does not invoke from Heaven an impossible help.

### 3. Conclusion

Our research project lends itself to several applications and future developments. First, the organicity and inner coherence of the musical suite makes it spendable in concert halls and musical programs. Second, we envisage a possible impact on science and theatre education, involving young generations of students to deal with interdisciplinary according to new motivations and perspectives.

In the future, we plan to extend the project by including also the other themes of the exhibition, that is, Speleology and Astrobiology. We will develop the interaction between Man and Nature in caves and - albeit for the moment on an imaginative level - habitable planets. The one-act we are setting up is a storytelling of the history of humankind: we will come back to the first inhabitants on Earth in

the caves, move through the quest and discovery of new lands in 16th and 17th centuries - namely, expeditions to explore new continents as Antarctica, culminating with nowadays space exploration and questioning about origin and distribution of life in the Universe.

Audio-video recordings are available at the following link (from December 2020): [https://www.youtube.com/channel/UCePz\\_709RK52IjDGc6LnFpw](https://www.youtube.com/channel/UCePz_709RK52IjDGc6LnFpw)

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