The Music of the Love Hormone – Oxytocin (8:48)

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Mihail Iossifov for Art & Science Research Foundation “Re:”; 2014.

The Music of the Love Hormone – Oxytocin represents the challenge to translate biological form (science) into musical form (art). Using a specially developed methodology, we linked the two sides affecting human emotions: hormones, from the inside (science), and music, from the outside (art).

DNA codes the proteins, such as hormones, via four letters (nucleic acids) forming three-letter words (codons). Each codon sets one amino acid from the protein’s structure. We have developed an original algorithm in which each codon of DNA represents a certain note. The length of the note is determined by the time needed for the ribosome (cell organelle, producing proteins) to add the corresponding amino acid to the structure of the protein. In this way, the sequence of musical notes is mapped onto the DNA code, and the three-dimensional structure of the protein determines the music tempo.

The objective of this investigation is to present the properties and the impact of one of the most important human hormones: oxytocin, a hormone called “the love hormone.” Oxytocin is produced in the brain, in the hypothalamus, and is involved in social recognition, maternal affection, and possibly in the formation of empathy and trust between people. As a result, we generated a complete, extremely provocative musical work. In order to verify the accuracy of the musical interpretation, a neurological test was performed and the neurological impact of the hormone and its music was investigated. The preliminary results of this study are presented in this issue [1].

The developed methodology is innovative and creates bridges between art and science knowledge: Physics, genetics, molecular interactions, human physiology, neurology, biofeedback and neuroaesthetics are correlated with music theory and human perception, aiming to get one step further in the development of a “complete mind.”

The Music of the Love Hormone – Oxytocin started as an initiative of Art & Science Research Foundation “Re:” in 2014 in Sofia, Bulgaria, fulfilling the challenge to translate biological form into musical form. It is a result of the collaborative work of a cross-disciplinary research team specially assembled as follows: Tsvetana Ivanova, art and science project director; Rositza Marinova, PhD physics student; Todor Ivanov, physicist and algorithm developer; Leandar Litov, physicist; Agnieszka Deynovitch, biofeedback; Mihail Iossifov, composer and musician; and external experts: Dimitar Kolev, neurologist, and Elena Lilkova, computer simulations and 3D structure of the oxytocin receptor.

The composer Mihail Yossifov underwent in-depth scientific training about the genetic structure and principles and corresponding 3D structures and intermolecular behavior of the hormone, from its birth and its transportation to the receptor, along with its neuropsychological properties. After internalizing all this knowledge about the invisible nature of this most important human hormone, he had to translate its structure and development processes reference to the laws of music. The composition follows the precise timing and dynamics of the natural laws revealed by the respective scientific disciplines and integrates them into an original art and science composition.

Reference


MIHAIL YOSSIFOV’s Sextet, founded in 2009, rapidly became one of the most popular jazz acts in Bulgaria. In 2013 Mihail Yossifov Sextet released its first album, Broken Windows. Among the musicians he has collaborated with are Mike Stern, Dave Weckl, Mezzoforte, Dephazz, Peter Herbolzheimer, Karen Bernod, Poogie Bell, Max Moya, Randy Brecker, Milcho Leviev, Theodossii Spassov, Angel Zaberski, Antoni Donchev and Hristo Yotzov.

TSVETANA IVANOVA is a lecturer at University of the Arts, London—Central Saint Martins in Applied Imagination in the Creative Industries. She has a PhD in Art Psychology with “Neuroaesthetics of Emotion and Contemporary Art Forms.” She is founder and CEO of the Art & Science research foundation “Re:” and is currently working on a chain of interdisciplinary projects.
For the project Solo(s), we used Karlheinz Stockhausen's Solo für Melodieinstrument und Rückkopplung (1965–1966) as the starting point for investigating the affect and effect of technological transference when reproducing historical repertoire with live electronics.

A suggestion of technical transparency often accompanies digital sound technologies; we aim to challenge this notion. Rather than transparency, we argue that the coloring that emerges with digital media can be (and perhaps should be) used to inject new life into and ask new questions of the works that are being preserved.

Starting from the information gathered from the score, various texts and interviews, we were inspired by the realization that the first commercial recording of Solo contained additional sound material that was taken from other pieces and was not just a recording of what the delay system generated. Realizing that Stockhausen decided to use additional sound material for the early releases of Solo to achieve the desired timbre richness, and understanding that the live concert and the recording situations are different “beasts,” the question arose: How can we incorporate additional timbre layers into the concert performance while preserving the live nature of it (i.e. not using prerecorded material)?

With the aim of evaluating how different this new performance would be from a conventional one, and working on finding creative solutions that, while allowing for multi-timbre layers, could still be perceived as a rendition of Solo, we decided to stick to a single formschema, focused on a single electronic operator in charge of unfolding the musical structure, regardless of the number of layers of incoming sound material.

Even though all instrumentalists perform the same schema, linked by a synchronized clock, each performer was required to prepare his/her own version of the score for the concert, using the interpretations scheme provided in the score. This is a fundamental aspect of the musical preparation of this work, and the process of preparing the part is thoroughly prescribed in the full score. As a consequence, each musician contributes not just an instrumental timbre but also an individual rendition of the formschema, while the overall time-grid of the formschema remains consistent.

The performance in this recording is based on Formschema I and is rendered by Karin de Fleyt (flute), Brice Soniano (networked double bass) and Juan Parra Cancino (technical setup and live electronics). For this recording, we sought to strike a balance between sound quality and exposure of the different timbre coloring that the multiple technical layers (live flute, networked double bass, live sound processing of both “in situ” and networked signals) are filtered by.

JUAN PARRA CANCINO studied composition at the Catholic University of Chile and sonology at the Royal Conservatoire The Hague (NL), where he obtained his master’s degree with a focus on composition and performance of electronic music. In 2014, he obtained his PhD degree from Leiden University (docARTES program). His compositions have been performed in Europe, Japan and North and South America in festivals such as ICMC, “Sonorities,” “Synthese” and “November Music,” among many others. Since 2009, Parra is a research fellow at the Orpheus Institute (Ghent, BE), focusing on performance practice in computer music. <www.juanparrac.com>

KARIN DE FLEYT is a renowned soloist in contemporary music, constantly looking for new experiments, often resulting in rewarding collaborations with many well-known composers. Together with Carla Rees, she founded the duo NewFlow, which commissions duos for low flutes. De Fleyt is a principal lecturer at Leeds College of Music, a researcher at the Artesis Plantijn University College, a PhD candidate at the University of York and a laureate of the Orpheus Institute. <www.karindefleyt.be>

BRICE SONIANO is a French bassist who graduated in 2005 from the jazz and classical departments of Den Haag Koninklijk Conservatorium, where he studied under the supervision of Knut Guettler, Hein van de Geyn, Jean-Paul Everts and Frans van den Hoeven. Soniano then went to live with a Baka pygmy population in the Cameroon rainforest together with his partner, Mette Burild, and Toma Gouband. Since returning to Europe, he plays and records mostly improvised music, avant garde jazz and new music with musicians such as Harren Fraanje, Michael Moore, Christian Mendoza and Maurice Horsthuys’s string ensemble Jargón, among many others. <www.bricesoniano.com>

/S/ <S[OW]> (5:42)
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Composed by Nicolás Varchausky at DXARTS (Center for Digital Arts and Experimental Media), University of Washington, Seattle, U.S.A., 2011.

This piece is part of the long-term project Resonances, Turbulences & Explosions, which proposes an acoustic exploration of the alphabet through the creation of 3D sound pieces using the spectral components of letters and phonemes. The series takes its name from the basic acoustic properties of speech: When we speak, we filter turbulent streams of air, resonate in our heads periodic interruptions of those streams and release abruptly built-up pressure under the glottis.

The project represents the continuation of my artistic
research on the tensions between sound and meaning within spoken word and their possibilities as musical material. Evolving from my early pieces that explored the poetic resonances of everyday speech using field recordings and collage techniques, the current series reaches an utmost abstraction point in these investigations and refinement in its techniques.

The project relies on a process of analysis and resynthesis of recorded phonemes to extract the raw materials that are used to compose each piece, exploring and expanding the inaudible details of the acoustic component of letters. It focuses on the melodic gestures, rhythmic patterns, timbre fluctuations, stresses and pauses present in our everyday speech, surgically transforming every partial of a particular phoneme and bringing to the forefront its acoustic richness. Their hidden sonic treasures are unearthed through digital means and algorithmic processes, unfolding them in an immersive three-dimensional sound spatialization setup. For this particular release, a stereo mix was rendered out of the original Ambisonic version, using a UHJ decoder.

The series aims to immerse us in the lush depths of the phonemes’ hidden soundscapes in a quest for language’s ultimate acoustic matter and meaning.

NICOLÁS VARCHAUSKY (AR, 1973) is a composer, sound artist and researcher. He works as an associate professor at Universidad Nacional de Quilmes (UNQ) and Universidad Nacional de Tres de Febrero (UNTREF). His work explores the relations between sound, space, memory and spoken word, and includes electronic and instrumental music, sound art installations, performance and site-specific projects in public spaces. He runs the music label Inkilino Records <www.inkilinorecords.net> and his work has been supported and distinguished by Prix Ars Electronica, Internationales Musikinstitut Darmstadt, Goethe-Institut, and Festival Internacional de Buenos Aires, among others. He holds a PhD from DXARTS, University of Washington.

HEAVY METAL (10:06)


Composed by Dr. Nigel Helyer and Dr. Jon Drummond, 2016.

Heavy Metal—the fourth project in an annual series of installations designed to interact with the history, ecology and cultural landscape of the Bundanon Trust, NSW, Australia. Elements and minerals lay buried in the landscape, tracing diagrams of human activity. Specks of alluvial gold washed down to the floodplain from worked-out mountain mine shafts, the mineral auras that reveal the long-vanished outlines of farm buildings and the telltale chemical fallout from workplaces.

The painter Arthur Boyd depicted this (mineralized) landscape with colors that were themselves formulated from earthy compounds and exotic metals, milled to a fine paste in linseed oil and turpentine.

Heavy Metal invites us to interact with one of Boyd’s paintings in his old studio at the Bundanon Homestead to discover a hidden world of elements and minerals in an experience that is simultaneously chemical, visual and musical.

The initial concept for Heavy Metal arose after spending time onsite with Dr. Mark Taylor, an eminent environmental scientist (notorious for exposing the link between industrial pollutants and public health).

Taylor and his students have been surveying the mineral composition of the Bundanon Homestead property looking for traces of human activity that derived, for example, from onsite farm and workshop activities but also from effects of upstream mining for gold and other heavy metals.

Our intent is to create a mapping of human activity based upon this forensic evidence. While we were taking these environmental samples I invited Taylor to visit Boyd’s studio and suggested that he bring along his portable mineral analysis machine—as it struck me that we may have a great opportunity for rethinking Boyd’s works.

The starting point was that Boyd was situated in this landscape, painting the physical features, and using (or making himself) colors that were substantially minerals (originally of the earth), forming a metaphorical circuit!

Taylor was impressed by the massive levels of heavy metals in the materials painters used and was keen to collaborate—so we proceeded to analyze the mineral composition of the entire color range that Boyd used and came up with a huge database of minerals that corresponded to his “palette.”

We sampled the Steinway piano in the Homestead note by note: first, regular keystrokes, and secondly, the reverberance of the sounding board with one- to two-minute recordings per note.

Working with another colleague, Jon Drummond, who is an expert in data sonification, we have created a computer-driven audiovisual system that displays a video stream from the camera mounted facing Boyd’s painting The Return of the Prodigal Son.

The screen interface displays a highly magnified color “target” on the painting, the RGB values as well as the predominant minerals present in each color area.

The sound has two components—a generalized harmonic chord structure that corresponds to the color, with individual note highlights illustrating the most prominent minerals. The computer monitor gives feedback on the area of interest, color ratios and a graphical display of the minerals detected.

Acknowledgments

Heavy Metal is a collaborative work by Dr. Nigel Helyer, Dr. Mark Taylor and Dr. Jon Drummond and was produced for Siteworks 2016 as part of the “When Science Meets Art” Australian Research Council (ARC) Art and Science research project.
DR. NIGEL HELYER is a contemporary artist whose work contains several highly developed creative interests. He produces intriguing and continually inquisitive work of international standard and is able to bring new scientific and artistic partners into truly collaborative artistic projects. He is able to do this through his capacity for deeply immersive site-research and his commitment to collaborative and interdisciplinary enquiry. Nigel is Adjunct Professor in Media, Music, Communication and Cultural Studies at Macquarie University, Australia.

DR. JON DRMUMOND is a sound artist and composer whose work explores interactive electroacoustics, robotics, sonification of natural phenomena, acoustic ecology and real-time interactive performance systems for acoustic instruments. His works have been presented at many festivals and conferences, including The Adelaide Festival, the International Computer Music Conferences, New Interfaces for Musical Expression, and the World Forum for Acoustic Ecology. Jon is Associate Professor in the School of Creative Industries at University of Newcastle, Australia.

VALDIVIA’S WETLAND SOUNSCAPE (5:01)

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Composed by Felipe Otondo, 2016.

This audio track was one of the outcomes of an interdisciplinarian research project aimed at exploring the temporal evolution of urban wetlands’ soundscapes in the city of Valdivia in the south of Chile. Continuous 24-hour stereo field recordings were carried out at the Parque Urbano wetland using a specially designed recording system that included a spaced-pair microphone technique aimed to capture timbral and spatial sonic attributes of the wetland’s wildlife activity. Field recordings in this wetland were carried out at noon on Friday, 15 March 2015, at the height of the toads’ breeding period, at a distance of four meters from the marsh wetland area. I edited 24 short audio samples of each recorded hour and assembled them chronologically to create a 5-minute time-lapse audio montage aimed at capturing the 24-hour sonic evolution at the specific wetland. On the one hand, this method provides an effective and subtle listening method/tool that enables listeners to appreciate in full the richness and diversity of the wetland’s wildlife. On the other hand, it became an effective acoustic monitoring tool to recognize the recurrence of particular sonic events within the wetland area and assess the impact of anthropogenic-generated noise from neighboring housing developments. I used audio files created using the time-lapse montage method described above were used to create two sound installations at a university and a museum in the cities of Santiago and Valdivia. Dozens of people provided very positive feedback about these installations. Participants’ responses showed that the proposed sonic time-lapse method is a simple but powerful tool to engage audiences from various backgrounds with the cultural heritage of urban wetland soundscapes.

FELIPE OTONDO (1972) studied composition at the University of York, U.K., with Ambrose Field and Roger Marsh, focusing on electroacoustic composition and experimental theater. Festivals in more than 30 countries across Asia, Europe and North and South America have played his music. Felipe is currently a senior lecturer at the Institute of Acoustics at Universidad Austral in Chile.

RECORDED AUDIO RESPONSES (5:36)


Anonymous responses, streets of Brooklyn and Queens, 2015.

Recorded audio responses to questions about public art in general and to Jeff Koons’s Split-Rocker in particular, which was visible in a viewer. The Public Utteraton Machines, an interactive public art project by Rebecca Hackemann in the form of solar-powered recording telephones on the sidewalks in Brooklyn and Queens, New York, 2015, recorded the audio. The Public Utteraton Machines are interactive public artworks that look like public telephones from the twentieth century. Their aim is to find out what people think about public art in New York or other cities. They record opinions and feature a push-button survey. The project’s aim is to intervene into the practice and discourse of public art in areas of New York City where public art is not normally found. The Public Utteraton Machines use audio recordings to ask passersby whether they have seen other public art and what they think of it and then collect that data quantitatively.

REBECCA HACKEMANN is a British/German/American conceptual artist/researcher who works in a variety of media such as stereo photography, 19th century photographic processes, projection, drawing and public art. Her work is concerned with viewer interaction, perception and the construction of virtual, private and public space. She is a PhD candidate at Chelsea College of Arts London and assistant professor at Kansas State University, Manhattan, Kansas, U.S.A.