# Workshop

# **Biofeedback in artistic context**

# by Dr. Valery Vermeulen



#### Short description of the workshop:

Main theme of this four day workshop is the use of techniques coming from the domains of biofeedback and psychophysiology in an artistic context. Under biofeedback and psychophysiology a subdomain of psychology is hereby understood where the link between bodily reactions (such as heart rate, stress or brain wave activity) and human emotions is being studied. Bodily reactions are measured using biosensors such as heart rate measuring devices (ECG, electrocardiogram), brain wave measuring devices (EEG, electroencephalogram) and stress level measuring devices (GSR, galvanic skin response).



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As starting point of the workshop an overview is presented on how biofeedback was and is used by various artist and in different artistic contexts. Examples that will be discussed here include *Music for Solo Performer* (1965) by Alvin Lucier, *Spacecraft* (1967) by Richard Teitelbaum, *On Being Invisible* (1977) by David Rosenboom, *Heartchamber Orchestra* by Peter Votava and Erich Berger (2012) and *EMO-Synth* (2009 a project that was realized by the author). Throughout this overview several ways will be extensively discussed on how to use biofeedback in different artistic settings. After this overview the workshop will focus in a second part on the field of biofeedback. This second section covers a hands on training on how to measure which sort of bodily reactions with which sort of biosensors, how to connect the biosensors to a digital system and how to read, import and process the measured data in the computer.

Once the attendants are familiar with these aspects they are taught in a third part of the workshop how to use the biosensors in their own artistic practice. This can be a musical context, context of multimedia or installation art as well as the context performance or visual art. Software that is used throughout the third part of the workshop is Pure Data, Processing, Audacity and Reaper. After a thorough introduction and practical sessions each attendant will be giving the opportunity to elaborate and realize an own artistic project which integrates biofeedback. On the last day the workshop is concluded with a presentation moment where the projects that are created during the workshop can be presented to the public.



# **Practical:**

What to expect from this workshop:

- 4 days workshop from 10u00 till 17u00 + exhibition/presentation moment on last day.
- Program of the workshop:
  - Day 1:
    - Introduction into history of biofeedback and how it has been used in the arts in the past and present
    - Introduction into biofeedback and psychophysiology from scientific point of view
    - Basics of sound design using Pure Data en Audacity
  - Day 2:
    - Practical use of biosensors and connection with digital systems (computer, arduino, Raspberry Pi,...)
    - Hands on training how to read, use and interpret psychophysiological data
    - Start of personal projects
  - Day 3:
    - Elaboration of personal projects under guidance and coaching of the teacher.
  - Day 4:
    - Finishing of personal project and preparation of exhibition
    - Exhibition of projects that are realized during the workshop
- As to the use of biosensors in the workshop there are two possibilities:
  - 1) As attendant of the workshop you use in small groups a biosensor that is available. Biosensors that are available during the workshop are:
    - Neurosky Mindwave (<u>http://www.mindtecstore.com/en/mindwave</u>): EEG or

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brainwave measurement

- Sparkfun HRMI ( https://www.sparkfun.com/products/8661) + Polar T31C ( <u>http://www.polar.com/us-en/products/accessories/T31\_coded\_Transmitter</u>): ECG or heart rate measurement
- Audiostrobe Mind Reflection
   (http://www.audiostrobeshop.co.uk/index.php/biofeedback/mind-reflection-gsr-to-usb-interface-detail): GSR or galvanic skin response
- 2) As an attendant you bring your own biosensor(s) to use for your own personal project you want to elaborate during the workshop.

# **References:**

Video/links:

- <u>https://www.youtube.com/watch?v=tTrhAB80G70</u>: TEDxTalk by author on EMO-Synth
- <u>http://www.emo-synth.com:</u> website of the EMO-Synth project by author
- <u>http://www.valeryvermeulen.net:</u> artist website of author
- <u>https://www.youtube.com/watch?v=T3FJ4YYJC0U:</u> *Heart Chamber Orchestra* (2012), Peter Votava and Erich Berger
- <u>https://www.youtube.com/watch?v=bIPU2ynqy2Y:</u> Music for Solo Performer, (1965), Alvin Lucier
- <u>https://www.youtube.com/watch?v=e-OaumT8w8o:</u> David Rosenboom with John Lennon, Yoko Ono en Chuck Berry on biofeedback

# Literature:

Vermeulen, V. (2014) Affective computing, biofeedback and psychophysiology as new ways for music composition and performance. In: *Contact 16.3! Toronto Electroacoustic Symposium* Link: http://acc.sonus.og/acontact/16\_2/vormaulan\_affectivesemputing.html

Link: <u>http://cec.sonus.ca/econtact/16\_3/vermeulen\_affectivecomputing.html</u>

- Vermeulen, V. (2012) The EMO-Synth, an emotion driven music generator. In: *eContact* 14.2! Biotechnological Performance Practice Link: <u>http://cec.sonus.ca/econtact/14\_2/vermeulen\_emosynth.html</u>.
- Vermeulen, V. (2012) The EMO-Synth, an intelligent music and image generator driven by human emotion. In : *Proceedings of the 15<sup>th</sup> Generative Art Conference GA2012*. Greaadpleeg op 26 januari via http://www.generativeart.com/GA2012/valery.pdf.
- Leman, M., Vermeulen, V. et al. (2004) Correlation of gestural musical audio cues and perceived expressive qualities. In: Camurri, A. & Volpe, G. (Eds.), *Gesture-based communication in human-computer interaction*. Berlin, Heidelberg: Springer-Verlag.
- Rosenboom, D. (1974). Biofeedback for the Arts, Results of Early Experiments. Vancouver

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Aesthetic Research Center of Canada Publications.

• iMAL, Center for Digital Cultures and Technology, Brussels. Link: <u>Tangible Feelings: A</u> <u>symposium on EEG (and biofeedback) for the Arts.</u>

# Software:

- Pure Data: <u>http://puredata.info/</u>
- Processing: <u>http://processing.org/</u>
- Audacity: <u>http://audacityteam.org/</u>
- Reaper: <u>http://www.reaper.fm/</u>

# **Technical requirements:**

- Working space
- Beamer and small sound system
- The attendants bring their own computer or laptop and headphones
- Remark: if the attendants want to experiment with their own biosensors there are low cost biosensors such as the:
  - Mindwave Mobile interface by Neurosky (<u>http://www.mindtecstore.com/en/mindwave</u>).
  - Sparkfun HRMI (https://www.sparkfun.com/products/8661, 59.95 \$) that works with a Polar coded chest transmitter of type T31C (<u>http://www.polar.com/us-</u> en/products/accessories/T31\_coded\_Transmitter, 45.95 \$).
  - Bitalino : DiY Body Signals (<u>http://www.bitalino.com/</u>, 149 €)

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#### About the teacher:

Dr. Valery Vermeulen is electronic musician, music producer, mathematician, new media artist, author and visiting professor at Erasmus University College in Brussels where he teaches on multimedia art and technology. In 2001 he obtained a Phd in pure mathematics at the Ghent University (Belgium) conducting ground breaking research in the field of algebraic group theory. Between 2001 and 2005 Vermeulen worked at the Institute for Psychoacoustics and Electronic Music (IPEM, Ghent University) on a research project focusing on the link between music and emotions. Meanwhile he started writing and recording music in my his own production studio. Since 2003 Vermeulen has been working on various interactive multimedia projects where the man machine interaction plays a central role. Topics in his work cover a broad range of disciplines including creative evolutionary systems, generative art, algorithmic sound and image generation, affective computing, artificial intelligence, econometrics, sound design, data sonification and music production. As examples of his recent projects we can mention EMO-Synth, Krystal Ball and Mikromedas. With the EMO-Synth project Vermeulen's work is situated in the area of interactive multimedia systems where automatically generated sound and music systems are directed by the emotional responses of the user (more info at: http://www.emo-synth.com). In the Krystal Ball project, an interactive multimedia system where the mechanisms that caused the financial credit crisis, stochastic and algorithmic music generation and the work of pioneer I. Xenakis play a central role. With his most recent project entitled Mikromedas (more info at http://www.mikromedas.net) focus is set on the innovative uses of data from space and deep space as new tools form music composition and performance. Vermeulen's installations and performances have been widely shown in Belgium as well as abroad. Locations and venues of where his work was shown include Slingshot Festival (Atlanta, US), TES (Wychwood Theatre, Toronto, CA), IMT (Institute for Advanced Studies, Lucca, IT), Technical Museum Zagreb (Zagreb, HR), BEAF (BOZAR Electronic Arts Festival, Brussels, BE), DEAF Festival (Dutch Electronic Art Festival, Rotterdam, NL), GOGBOT Festival (Enschede, NL), W139 (Amsterdam, NL), TEDxFlanders (TEDx, Antwerp, BE), Agora Collective (Berlin, DE), Liebig 12 Gallery (Berlijn, DE), Korrekt Gelände (Frankfurt, DE), GRETA Gallery (Zagreb, HR), MHKA (Museum of Contemporary Art Antwerp, BE), MHKA Media (Museum of Contemporary Art Antwerp, BE), Musical Instruments Museum (MIM, Brussels, BE), Atomium (Brussels, BE), Beursschouwburg (Brussels, BE), Z33

(Hasselt, BE), STUK (Leuven, BE), Vooruit (Ghent, BE), Tour & Taxis (Brussel, BE), Happy New Ears Festival (Coutray, BE), artcinema OFFoff (Ghent, BE), Art Gent (Ghent, BE), Pecha Kucha (Ghent & Brussels, BE), DORKBOT (Ghent, BE), Royal Conservatory of Ghent (Ghent, BE), KASK Cinema (Ghent, BE), Gallery Tatjana Pieters (Gent, BE), on national radio channels KLARA, Radio1, Radio2 and Studio Brussels and national television channels Ketnet and TV Brussels. Besides his artistic and educational activities Vermeulen currently also works as a statistical expert and consultant and recently finished his studies as music producer at the Royal Conservatory of Ghent.

More info at http://www.valeryvermeulen.net/