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SURFING SOUNDWAVES

The act of surfing waves experienced through music

A written reflection within the degree project that is also documented with a video that can be found here: www.vimeo.com/rosannagunnarsson
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Introduction

To become the energy of the wave, that’s the main idea. You take when the water give's, and you give when the water takes. It’s a constant interplay of bold confrontations and mellow respect.

- Billy Hamilton

The ancient Hawaiians believed that people could achieve greatness only after establishing a balance among themselves, their fellow humans, and nature. In much the same way you cannot become a truly great surfer until you have struck a balance among you, your fellow surfers, and the ocean. In other words, surfing is more than just jumping on a board. For some it can be a metaphor for life.

- Raul Guisado

In a few words the two quotes above explain what I find so interesting about surfing. The way Billy Hamilton views surfing as an interplay with energy, and how Raul Guisado sees it as a metaphor for life. These two perspectives is why I thought it seemed so fitting to explore how surfing would work as the basis for a musical idea and concept.

Before this project I had never surfed a wave. I grew up in the archipelago and had been in and around water a lot, but I had never been standing on a surfboard. After a project I did about the physics of skateboarding I started to imagine being carried by flows of water instead of riding on a road. I imagined moving against and with a part of nature instead of just on it. I imagined being fully present while performing maneuvers on the face of a

1 Ben Marcus, Surfing and the meaning of life, Voyageur Press, 2006, page 17
wave that breaks whether I'm ready for it or not. It was a fascination at first but accelerated to obsession as soon as the thought "I wonder how it sounds" entered my mind.
About the project

From the start the goal with this project has been to make a sounding interpretation of the act of wavesurfing from the perspective of a surfer and an exploration of the possibility to create soundprints that with music captures and recreates physical movements, experiences and moments of flow.

To do this I have collected physical data from a surfer surfing the waves at Torö Stenstrand (the most "famous" surfbreak in the Stockholm region) that I later connected to chosen musical parameters such as rhythm, pitch, tempo and texture. Because the goal was to capture the experience of surfing waves I also recorded sounds of the waves and the surroundings and mixed it together with the written out music.
The process

As any process leading up to something I started of with lines of thoughts where one led to another, that lead to another. Early on I decided to make this piece partially electronic so that I could play around with more variations of sound. It also made sense to explore the physics behind surfing further to get a deeper picture of what factors is involved in the activity. Another early thought was to make the piece personal. To not only use the collected data from the surfer as inspiration or a foundation for a tone-series, but to capture and re-tell a surfing session from a surfers perspective.

When I thought of the piece as real-time and linear it changed to become more about the surfer's experience as a whole, and that made me think about capturing the sound environment to recreate the sounds and atmosphere surrounding the surfbreak. From the thought of recording the sound environment came thoughts about the wave sounds. I decided to make the waves into an equal factor and musical parameter that the surfer rides and tackle in different ways.

To sum it up, I started with this plan:

Surfing soundwaves will be a partially electronic and visual piece told in a linear perspective. It will be divided into different building blocks - The environment, the waves, and the surfer. The environment is going to be represented by recorded sounds, the waves by processed recorded sounds, and the surfer by either synthetic melodic sounds or acoustically played sounds written after results from different measurements made during a surfing session.

After the plan was made I divided the process into different parts as well:

- Collecting facts (deciding and connecting parameters),
- Collecting data and recording sound
- Making music
Collecting facts

Timeframe: From September to early December

If the two quotes in the introduction explained surfing from a symbolic and emotional perspective, the following takes a more concrete approach in characterizing surfing as an activity.

Surfing is an intermittent exercise that comprises bouts of high intensity exercise interspersed with periods of low intensity, activity and rest. The action of surfing usually involves the surfboard being paddled out in the prone position until the surfer is behind the area of breaking waves at the “line up” or “take-off zone”. Once in the “line up” the surfer waits until a suitable wave approaches, then with some powerful sprint-type arm strokes the surfer accelerates the board to match the speed of the incoming wave to allow the surfer to “catch” the wave as it pitches and begins to break. Once the surfer catches the wave, they then stand up and accelerate down the unbroken part of the wave and begin to perform a series of maneuvers on the wave face until the wave breaks completely, the surfer falls or the wave flattens out. This process is then repeated. ³

The article above opened up my mind to a scientific perspective that became important in this first phase of the project. It says nothing about the feeling, nothing about flow or purpose for the person surfing, but very much about the actual activity. I now understood that surfing is a sport that consists of paddling, riding waves, and waiting with occasional periods of tumbling around underwater (after wiping out/falling of the board). I related this explanation of surfing to form, what will happen and when.

The next step was to find out which physical factors within the surfer made riding waves possible. Which parameters are key elements in why you

³ BJ Lowden quote from the study by M.J. Barlow, M Findlay, K Gresty, C B. Cooke. Anthropometric variables and their relationship to performance and ability in male surfers, European journal of sport science, published online: 2012-03-19
finish a wave or fall of? Kelly Slater, one of the sport of surfing's most successful athletes wrote this in an article:

Speed. The essence of riding waves. There is no one magical secret to moving on a wave, but to extract as much speed as humanly possible from a wave depends on your knowledge of key elements such as equipment, your body, and the wave itself.4

I turned to research in the biomechanical field finding an article from California state university where they research the physical aspects of surfing:

While the concept of surfing appears simple - all you technically need is a wave and a surfboard - anyone who has attempted surfing knows that the reality is much more complex. Physically speaking, surfers are essentially strong swimmers with a keen sense of balance. Stamina and upper body strength are crucial in order to paddle from the shore through breaking waves to reach the surf line. Once there, surfers wait on their boards and then paddle intensely when a quality wave presents itself. As the wave peaks, a surfer must stand rapidly and smoothly from a lying down position, balancing in a fluid upright position as they glide on the breaking wave toward the shore.5

I spent a lot of time reading research papers and articles until I gathered up the facts about surfing and its key elements that I had found and started to think about them in terms of music. It wasn't until then that the artistic choices started to align one by one. Now I needed to think about each physical parameter affecting the surfer, and each musical parameter

4 Slater, Kelly. Surfing with Slater. Surfer magazine. 2010-08-17 http://www.surfermag.com/features/surfing-with-slater-intro/#lrhV2OMIsDp8Wsyq.97,

affecting the music, and somehow map these together to get a result that for me seemed representative of the activity.

As before stated I knew balance, speed, biomechanics, energy expenditure, and external forces acting up on the surfer are key elements that surfers works with. The musical parameters that I chose to map to physical parameters was tempo (bpm), rhythm, harmony, frequency, articulation, texture, dynamics, and space. I thought about giving panning/sound placement its own category but decided to leave it more free to use when I felt like it (mainly because I was writing it as a stereo piece and if I mapped panning to wave direction I think the listener would become bored or get dizzy by the constant movement between right and left speaker).

Below is a compilation of the parameters, how they are mapped and why.

<table>
<thead>
<tr>
<th>Heart rate - Tempo/Bpm (Higher heart rate = higher BPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The surfers BPM is directly connected to his/her heart rate. The tempo zones will be set to the lowest threshold for that particular zone, and I will use accelerando/ritardando to move between them. To connect heart rate to tempo seems like the most logical solution because of the tempo parameters relation to heart rate in general.</td>
</tr>
<tr>
<td><strong>HR zone per activity:</strong></td>
</tr>
<tr>
<td>Paddle hard - to catch wave = 4 (140-160 bpm)</td>
</tr>
<tr>
<td>Duck diving = 4 (140-160 bpm)</td>
</tr>
<tr>
<td>Paddle slow to line-up = 2-4 (100-160 bpm)</td>
</tr>
<tr>
<td>Surfing wave = 4-5 (160-180 bpm)</td>
</tr>
<tr>
<td>Diving off = 1-4 (60-160 bpm)</td>
</tr>
</tbody>
</table>
Lying on board - waiting = 1-2 (60-120 bpm)\(^6\)

**Surfer speed - Rhythm (Faster Speed = faster rhythm/note values)**

The surfer's Rhythm or note values are connected to his/her velocity or surfing speed going against/with the angle of the wave trying to stay in front of the face. Meaning that the surfer's rhythm will always (if the wave is surfed ideally) be a little faster than the wave. The note values are placed along speed zones.

This also seems like the logical solution because of the surfer's constant changes in speed. I hope it will give the music variation in sense of rhythm, but also invoke an understanding for the different speeds at which the surfer rides.

**Speed groups per activity:**

- Paddle hard to catch wave = 2 (4.1- 8 km/h)
- Duck diving = 2 (4.1- 8 km/h)
- Paddle slow to line-up = 1 (1- 4 km/h)
- Surfing wave = 3-9 (8.1- 40 km/h)
- Diving off = 3 (8.1- 12 km/h)
- Lying on board - waiting = 0 (0-1 km/h)\(^7\)

**Centripetal force/Moment of Inertia - Texture (More CF = more granulated)**

A low centripetal force (below 1000 N) will have a smooth and clear kind of texture. Centripetal force values above 1000 N will have a granulated texture that

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\(^6\) Heart rate zones was found a study by Oliver Farley, Competitive Surfing: A Physiological Profile of Athletes and Determinants of Performance, Auckland University of Technology, 2011, p. 43

\(^7\) Speed zones was found in this study by Oliver Farley, Competitive Surfing: A Physiological Profile of Athletes and Determinants of Performance, Auckland University of Technology, 2011, p. 43
increases depending on how high the value gets. This will make the texture changeable because of different amount of Centripetal force during different maneuvers. It is of course possible to change this texture parameter to something else. I chose smooth vs granulated because I relate grainy sounds to something that needs more force to break through.

The higher the centripetal force the harder it is to balance, that is why turning in a short narrow arc is always harder than wide arcs. Therefore higher centripetal force equals more granulated texture in this piece.

Muscle groups, summation of forces - Frequency (More muscles = more pitches)

Depending on the mass of the surfer he/she will be placed out on a frequency chart starting from the lowest C on a piano reaching up to the highest. Each surfer will get four octaves up from it's starting tone. The tone material will stay within that range to give the listener a sense of the person surfing (this is more important if I make a piece with more than one surfer). The range of the scale will also be divided into upper body (high range), core (mid range), and lower body (low range). My reasoning behind it is to differentiate between different actions and maneuvers and make them recognizable, for example: While paddling I will only use notes from the high and mid range because the surfer mainly use the upper body and core while performing that action.

Muscles that are static through the movements can be sustained tones or tones that ring out. I will give an example - When the surfer is paddling the lower body is mostly static, as opposed to when he/she does an aerial maneuver and the entire body is active. The pitch only follows the speed/rhythm while the muscle group represented is in movement otherwise it is sustained or silent.

8 Basis for my conclusions found in this article by Coleman, Scott. Balance: The Most Important Aspect of Surfing, surfscience.com, 2016
Muscle groups/maneuvers per activity:

Paddle to/from lineup: Upper body = motion Core = stable

Paddle hard: Upper body = motion Core = stable

Pop up: 1 - Upper body = motion Core = stable
        2 - Ub = stable C = stable Lower body = motion

Set up: Lower body = motion Core = stable

Bottom turn: Ub = stable C = motion Lb = motion

Top turn: Ub = motion C = motion Lb = stable

Snap: Ub = motion C = stable Lb = motion

Cutback: Ub = motion C = motion Lb = motion

Trim/pump: Ub = stable C = stable Lb = motion

Air: Ub = motion C = stable Lb = stable/motion

Kicking out/dive off: Ub = motion C = motion Lb = motion

Duck diving: Ub = motion C = motion Lb = stable

Sitting/lying on board: Ub = stable C = stable Lb = stable

Kinetic/potential energy - Space (More gained potential energy = more space/reverb)

Kinetic energy is a scalar that describes how much work an object in motion could perform and depends on the mass of the object, the acceleration due to gravity, and the height of the object.\(^9\)

In this piece more potential energy will equal more reverb (or pedaling on for example a vibraphone) to build up the expectations on the following actions. If the surfer gains speed and momentum from the potential energy I will let the wet


\(^10\) Basis for my conclusions found in a book by Duane Knudson. Fundamentals of biomechanics, second edition, California State University, Department of Kinesiology, Published by Springer Science + Business Media, 2007, p. 151-157
sound continue or ring out. If the surfer doesn't transfer the potential energy into something I will make the sound dry.

**Energy expenditure - Dynamics (More energy expenditure = higher dynamics)**

The energy expenditure of the surfer will translate to dynamics/how loud to play. Some actions/movements require more power output and because of that will be louder. The dynamic will be measured in note velocity or dynamic instructions relative to note velocity in midi.

Action movement → Energy expenditure levels (measured in METs) → Velocity

Paddle hard to catch wave = 8.0-11.0 METs = f-fff (96-126 v)
Duck diving = 7.0 METs = f (96 v)
Paddle slow to line-up = 6.0 METs = mf (80 v)
Surfing wave = 3.0 - 6.0 METs = p - mf (49-80 v)
Diving off = 3.0 METs = p (49 v)
Lying on board/waiting = 1.0-4.0 METs = ppp - p (16-49 v)\(^\text{11}\)

**Balance - Articulation (Less balance = more staccato, more balance = legato)**

As the centre of mass is kept within the line of gravity and base of support, the tones articulation is legato or tenuto, it increases to staccato, staccatissimo etc. the further the surfer's centre of mass goes beyond the line of gravity and base of support. For me a sound that goes from flowing into chopped bits describes the feeling of loosing balance. I often find that falling/loosing balance feels sudden even if its expected, and I experience a sound in legato that changes to staccato in much the same way.

\(^{11}\) Basis for my conclusions found in Compendium of Physical Activities: an update of codes and MET intensities, Medecine & Science in Sports & exercise, 2000, p.18
Mood and feeling of flow - Harmony

The harmonic scale/material for this piece will follow the mind and mood of the surfer. To get a contrast between feelings of stoke/satisfaction/excitement and frustration/fear/anger all the "positive" emotions should be notes from pentatonic scales and the "negative" disharmonic by altering notes from the pentatonic scale so that it looses it's pentatonic character. The moods in between "positive" and "negative" will follow a more modal approach.

I also knew the main parameters characterizing different waves are wind conditions (speed and direction), wave period, bathymetry, wave shape (peel angle and peel rate), wave height, and breaking intensity. I could have treated the wavedata with the same method as I did the surfdata (connecting it to a musical parameter), but decided to keep the waves as recorded but processed sound. I thought that only focusing on the surf-data would give me time to explore the method and not stress about by having two types of data on my hands. Hopefully I can turn the perspectives around in another composition later by focusing on the waves instead of the surfer. I think it was paramount for me to understand surfing from a physical and scientific perspective to be able to see why so many people enjoy it. And that there are physical factors like in many other sports that affect the way we think and feel while performing an activity. Having that approach made the last step of the process, making the music, much easier as I could relate the emotional aspect to physical theories and facts.

Collecting data and recording sound

Timeframe: From December to February

Now when I had connected the surfing and musical parameters, it was time to find a surfer to record and measure. Through the Swedish surf association I came in contact with a surfer named Love Berggren who has Torö
stenstrand (Torö pebble beach, translated) as his home break. As soon as the wind conditions were right and the waves somewhat pumping I headed out to record his physical data while he was surfing.

Before the session I had researched the beach and recorded wave sounds. This is what magicseeweed.com (a website dedicated to surf-forecasts) writes about Torö Stenstrand:

Several peaks over a rock reef that has been slowly moving closer to shore and reducing wave heights. Works when the wind comes from the SE-SSW at over 10 m/sec, or over 15 m/sec from the SW. Powerful waves from the Baltic and capable of handling double overhead swells. Wind direction should be north westerly, swell range is from 1-10 feet, the seabed is sandy, the character of the wave is a submerged reef with peaky waves, works in all tides.

Torö is the most surfed wave in Sweden attracting 50/60 surfers on a good day. About 70 kms south of Stockholm. Torö is the annual venue for the national surf competition since 1991. 12

The forecast for the day was:

<table>
<thead>
<tr>
<th>Wave height: 0.8-1.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary swell: 1.5</td>
</tr>
<tr>
<td>Wind speed: 11 mps</td>
</tr>
<tr>
<td>Wind direction: Strong, cross/onshore 216°</td>
</tr>
<tr>
<td>Wave period: 6 s</td>
</tr>
<tr>
<td>Air temperature: 5°</td>
</tr>
<tr>
<td>Water temperature: 3°</td>
</tr>
</tbody>
</table>

The equipment I used to measure Love's data was a Suunto heart-rate monitor (attached on a strap around the surfer's chest)\(^{13}\), Traceup gps monitor (attached on the surfboard)\(^{14}\), and a gopro action camera (attached on a mouth mount)\(^{15}\). This gave me data of his heart-rate, his speed, turn angles, energy expenditure, and video footage of the surfing from his eye-level perspective. During the time Love surfed I recorded sound and video from the beach.

When the surf session was over I made compilation of the collected data dividing it into waves, paddling and duck diving (diving with the board underneath breaking waves) and decided which part of the session would create the foundation for the music.

\[
\begin{array}{|l|}
\hline
\textbf{Wave 13 ST; 14:25 - 15,5 sec:} \\
\textit{Gopro} = \\
\hline
\textit{Paddle time before wave} = 1.2 \text{ min} \\
\textit{Max speed} = 31.4 \text{ kph} \\
\textit{Turn speed} = 1: 26.6 (+0.8 \text{kph}) \\
\quad 2: 26.2 (+1.4 \text{kph}) \\
\quad 3: 25.5 (+2.0 \text{kph}) \\
\hline
\end{array}
\]

\(^{13}\) The heart rate monitor - http://www.suunto.com/nb-NO/Products/Heart-Rate-Belts/SuuntoSmartSensor/

\(^{14}\) The gps monitor - http://www.traceup.com/

\(^{15}\) The action camera - http://shop.gopro.com/EMEA/cameras/hero4-silver/CHDHY-401-EU.html
Example of the data I got from the TraceUp gps monitor

All in all the session was two hours and ten minutes long and consisted of 38 ridden waves. From that I chose nine waves with 15 duck dives and paddle time in between to become the form of the music. I chose a 30 minute section that, in my opinion, contained the most exciting waves. I deviated from the original idea slightly by exchanging some waves that were similar to ones that had different maneuvers and outcomes. Then I
reduced the time in between some waves by cutting down the time of paddling. Those two decisions came from a discussion I had with a teacher about perceived time and how it can fly by much faster while being in a state of flow. I started to read more about flow in general and found that "a distortion of the temporal experience" is part of the definition of flow.

In addition to the reducing of paddle time I extended the time the surfer spends underwater to even further enhance the distorted temporal experience. That section of the piece is the most free in terms of connection between parameters. I wanted that underwater world to differentiate from the one above the water because to me it's often a different feeling both physically and mentally below the surface. To represent that I decided that all the calculated parameters above surface would not exist in the same way underneath.

The wave and environmental sounds were recorded with a Zoom H4 placed on the beach, a Røde shotgun microphone placed closer to the water, and the gopro's built-in microphone capturing the surfer's breathing (and some wave-splashes). I wanted to record the waves from surf zone with a parabolic microphone but couldn't get my hands on one within the project's timeframe.

**Making music**

*Timeframe: From February to April*

The first steps in turning the data into music was to edit the video footage according to the form I decided when analyzing the data. Then I started to place tempo, rhythm/note values, texture, articulation and dynamics to match the video. This created the foundation for the piece and the next steps

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was to fill in the more subjective parameters relating to harmony, frequency, and space (mood, muscle groups, potential energy).

The mood/harmony parameter (the surfer's state of mind during the session) was without question the one with the most space for interpretation and artistic expression during the composing process. I decided that I wanted the listener to get a sense of the mood by using a very recognizable harmony. When the surfer feels that everything is working and time flies by (being in a state of flow) I was going to use tones based on pentatonic scales. When the surfer gets smashed by waves and feels frustrated (both physically and mentally) I decided to make the flowing pentatonic harmony disharmonic by altering and adding tones. Of course there are nuances in between these emotions such as ambivalence where I decided on using different modal scales depending on the ambivalence being positive or negative.

Now the hard bit was to figure out what the surfer in my piece felt during the session I recorded. Probably the best thing would have been to do an interview right after the surf capturing those near in time reflections. But because of the weather in Sweden (especially in late January) standing at the beach didn't feel like the best time and place. Instead I figured it was up to me to interpret the different stages of emotion during the session by watching the video footage, listen to the breathing in the video, relating to my experience of high performance activities, and by surfing myself.

In the introduction to this text I mentioned that before this project I hadn't been wavesurfing. Having questions about the surfer's emotional and psychological experience led me to think that I had to do something about that. So I took a trip to Norway for a couple of days learning the basics in how to surf. I also took the opportunity and listened to the soundscape from surf zone, experienced the movements and how they felt in my body, and tried to get a clearer picture of what surfing can be and the factors involved. When I came home I tried to add the things I learned into the music. Two of
the main changes I did was to focus more on the feeling of different energy in waves by making some louder. I also changed the dynamics so that more force/louder dynamics was in the paddling and catching wave part of the activity rather than the wave riding.

The feelings I worked with in the music ended up being flow, frustration, ambivalence, impatience, and enjoyment. I did not include fear in this particular music mostly because that emotion didn't hit me at all during my surf. I believe fear is definitely an emotion that people can experience while surfing, but I think that the waves needs to be bigger than 1-3 meters for that to occur (at least if you are a good swimmer and feel relatively safe in the water).

A part from filling in all the pre-decided parameters and figuring out the harmony, I worked a lot with the processing and placement of the wave sounds (matching them to the video). I had recorded wave sounds during different conditions at Torö during the autumn and winter. I knew from reading about sound in surf waves that I was going to have a hard time capturing the overall sound environment standing at the beach (both due to wind conditions and not ideal recording equipment). Instead I found this article giving me hints about what to process and enhance in the recorded material that I had.
Spectograms of the noise radiated by a breaking wave show an acoustically active region of water which propagates with the wave, located between the leading edge and wave crest. The evidence from the acoustic and optical measurements is that the primary source of sound from the active region between 500 Hz and 5 kHz are the pressure pulses which accompany the formation of bubbles. The source of low-frequency sound below 500 Hz has not been determined, although a review of candidate mechanisms suggests bubble-amplified turbulence and the collective oscillations of bubbles within a plume could play a role. 17

An important perspective that I wanted to keep throughout the recording and composing process was that a microphone (or a camera for that matter) is, in my opinion, not an absolute truth teller. They work with the best of their constructed ability to capture what I'm pointing them at, but if not set up correctly or if the conditions don't suite their purpose, they don't capture everything. The way I see it is that then it's up to me as a composer to fill up on knowledge about the sound I'm recording, in this case wave sounds, so that I can add and adjust the recorded sound to be more similar to the sound environment I wanted to capture. I used GRM tools and Logic pro X's own equalizer to cut off some wind noise and enhance the lower frequencies to hopefully get a sound that is close to the real one of breaking waves in the surf zone.

One of the goals with the project was to capture moments of flow. Mihály Csíkszentmihályi and Jeanne Nakamura identify intense and focused concentration on the present moment, merging of action and awareness, a loss of reflective self-consciousness, a sense of personal control, a distortion of temporal experience where one's subjective experience of time is altered, experience of the activity as intrinsically rewarding, as factors that

17 Grant B. Dean. Sound generation and air entrainment by breaking waves in the surf zone. Marine Physical Laboratory, Scripps Institution of Oceanography, University of California, 1997-07-22, p. 17
encompass the experience of flow.\textsuperscript{18} My idea on how to capture flow was to bring all of my chosen parameters together according to the analysis of the surf-data and hope that flow would represent itself when tempo, rhythm, harmony etc. worked together (the harmony being pentatonic and the rhythm flowing in an even accelerando/ritardando and so on). Another representation of flow was the decision to reflect on perceived time in the form. I decided that the session didn't have to be chronicled exact in time according to the data but more to the perceived experience (although interpreted by me). This relates to my thoughts above about the recording and processing of the wave sounds as well.

Performance

I wrote this piece as a percussion duo with a soundfile and videoprojections, but difficulties during the rehearsals made me decide to make the music entirely electronic for the concert in April. I intend to edit the percussion score and hopefully have the piece performed with live-instruments in the near future.

In spite of the troubles with the live performance I was very satisfied with the outcome of the music. I feel that the piece both visually and musically reflects surfing for me, which was the main goal of the project. I cannot speak for others in this matter or make a claim that the finished piece is a universal reflection of surfing, as it is only a subjective representation of my own experiences. Something that did make me happy though was when people in the audience came up to me after the concert and said that they found the piece very meditative and got them thinking about their own relationship to a physical activity and flow.
Discussions

Troubles with the live performance

As I mentioned above I had problems with the notated material that originally was going to be played by two percussionist students on the master program at KMH. I have reflected on what went wrong and could have been done better by me. As I can not speak for them and their actions I will focus on aspects of the piece making it difficult to perform live and the necessity for such choices.

The first difficulty that I can think of is the nature of the piece itself, its intermittent form and the mapping of the parameters, that tempo relates to heart rate and rhythm to surf-speed. Those choices by me made the music extremely fast in some segments (mostly during the wave riding). My reason for that has been to make a representation of the different speeds a surfer has on different waves. In retrospect I could have made the percussion part easier by giving them less notes to play or lowered the tempo. On the other hand I believe that the benefit of having live musicians in this piece is if they embody the physical activity happening in the music and visuals. If the percussion part had lesser notes to play in a lower tempo perhaps that physical effort would be lost. The other difficulty could have been the need for synchronization between the music and the video. And because of that leaving next to zero space for the percussionists own interpretation of tempo. My opinion in this matter is that my goal was for the visuals and music to work together as a whole, and if that wasn't controlled from the beginning the margin for error would have been too large.

Perhaps the best thing for this particular piece was for it to be electronic. Because of it being the first with this method my need for the music to be a certain way was very big and leaving little space for the musicians own
interpretation. I will work with the percussion score to simplify some parts and write it as a piece for three percussionists instead of two. I'm also thinking about testing it without visuals in that version, maybe even without a soundfile, to see if the music itself (with the help of live musicians) can embody the act of surfing.

The necessity of the scientific approach

In the beginning of the project I had a need for a dogmatic approach to the collected data and its assigned parameters. Both in the little format where rhythm and tempo directly relates to speed and heart rate, but also in the larger sense where the music's form follows all the surfer's actions (from long bouts of paddling to intense wave riding). This could of course have been done differently. I could have given myself more freedom to interpret and edit the form (more than I did with the perceived time) and not always follow the perspective of the surfer. But being the first piece with this method I think I needed to get all ideas out of my head in a linear way for it to make sense.

Another question that came up after finishing the music was the necessity of the scientific approach. Would the music have been so much different if I didn't measure real data from a surfer? Could I have written the music anyway by proceeding from the decided parameters and my own experience of watching surfing? I believe that it wouldn't be the same. If that's positive or negative I'm not sure. I only know that having a scientific approach in the beginning of the project and imagining it being objective made me go places with the music that I couldn't have otherwise. An example of that is the parameter force/dynamics where I expected the force to be the greatest when the surfer ride's the waves, but through the collected data I came to realize that it was actually at its peak just before the wave riding started. The same goes for heart rate/tempo where I thought the logical thing was for the heart rate to peak during the wave riding but learned that it was actually
straight after. I think these two examples actually make's a difference in the perception of organic movement in the piece.

**Connection of mind and body?**

After my trip to Norway I began to think about music based on organic pulsation curves and if a physical approach to music can connect mind and body, and if that creates an imagining of movements. Before going I prepared to be somewhat disappointed or conflicted about surfing. What if it didn't feel at all as the music I was making? What if the soundscape was completely different then what I thought? And what if the sensation of surfing waves wasn't that euphoric for me as I hoped it would be? All those doubts was pretty quickly put down because from the start I was feeling it. The water, movements and physical sensation that I had researched and imagined for months felt very familiar. What I don't know is if this familiarity with the different parts of surfing came from only reading about the activity or if the composing of music according to surf data in combination with research had created a deeper understanding of surfing for me. If so I wonder which parameters mostly enables this?

My first thought is that logically it should be tempo. That the music follows the surfers heart beat and breathing, creating that intermittent feeling in the music and enhancing it in the visuals. But also rhythm and frequency that give's a sense of the speed and of the active/not active body parts. Force and dynamics should also contribute as they initiate the action (such as the force being largest before the wave riding) and get's followed by the rhythm that becomes faster, and then lastly the peaking of the tempo. The harmony parameter who in some way represents the mind perhaps completes the embodiment. That's what I hope anyway.
What should I call this way of making music?

When doing a project that explores something that at least for me is unknown territory it can arise questions about what to call it. It has for me and as it says in the introduction I want to call this "soundprints" to relate the music to my goal of capturing a person's movements. Or maybe I should call it "field composing" as that say's something about the documentation part of this approach. Which could also be a way to put it in relation to "field recording" but with the addition of composing instead of recording implying that the material won't be raw or unprocessed. Another suggestion I got was to call it "method composing" relating to "method acting" because of the way I as a composer approach the material.

Even if I'm at the last stages of this process I haven't made up my mind completely about what to call it. What I do know is that this way of making music encompass a documentation of places and experiences (both physical and mental) but not with an approach that it has to be used and then performed in its natural and untouched shape. For me it's more a question about capturing a feeling or a mental picture. I use scientific research, field recorded material, and physical results to get closer to those first impressions and perhaps an explanation to why I got them. In relation to other approaches within the art music scene I don't see this as an objective documentation of a place or experience, neither do I see it as programme music. It is a subjective reflection of an activity but it's not a story where I imitate movements. I'd rather see it as impressions of movements and speed's, or as music generated by kinetic energy where the goal is to create an understanding of an activity.
Concluding thoughts and notes for future works.

In every project no matter how successful the outcome there will always be room for improvement or other ways of doing it. I don't see this as an end or a completed process just because this music and text is finished. This was the first piece and exploration of a physical approach in my music making. In future works I would like to experiment with more recording equipment such as parabolic microphones and hydrophones. I want to play around more with different parameters and see how that changes the result. This way of making music is not static because it all depends on what parameters I map and how I approach them. Right now the possibilities seems endless.

I would also love to apply this to other activities. I'm looking at No-limit free diving and extreme skiing as alternative sports for this method of composing music.
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**Equipment:**

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