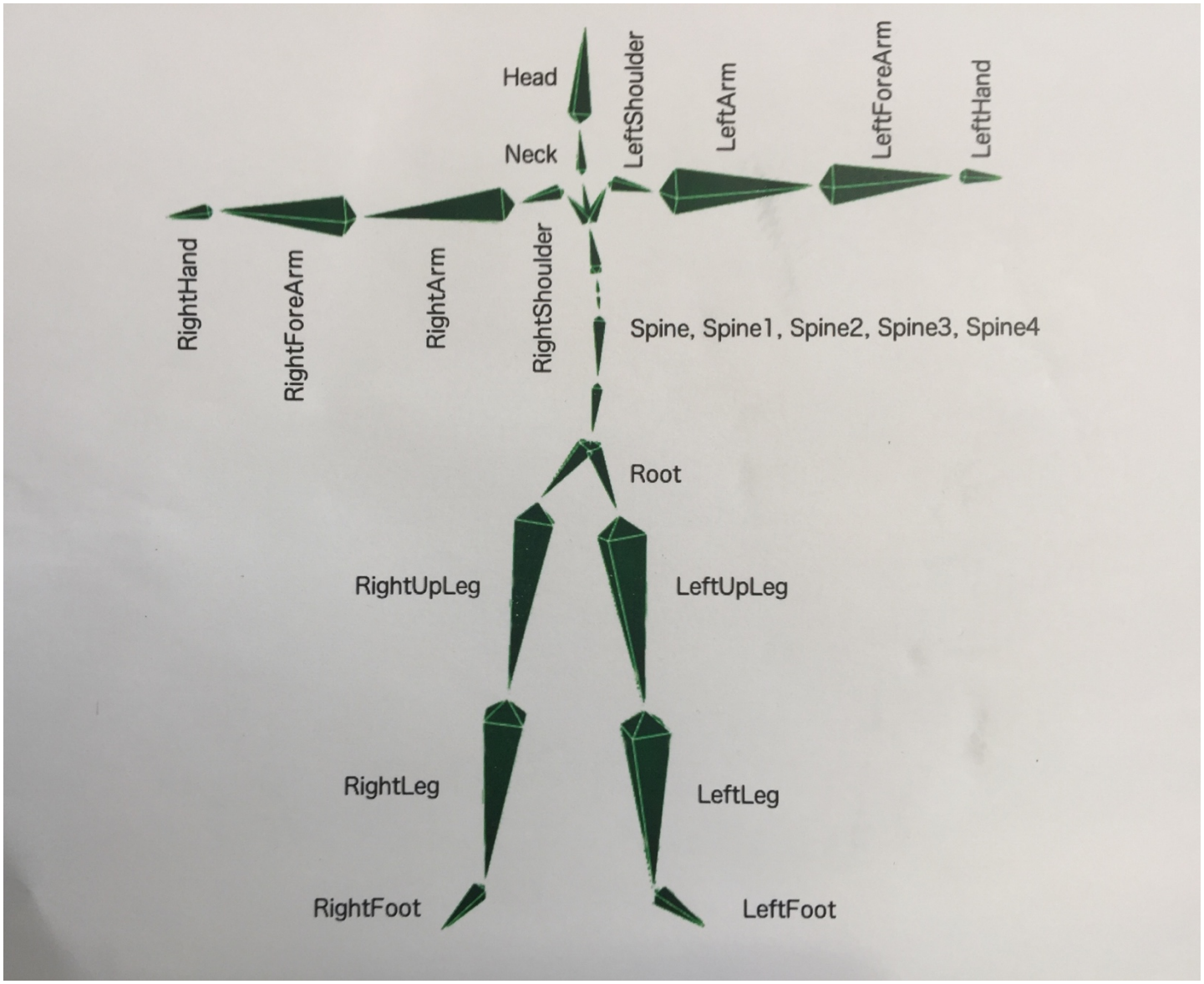
JUST DANCE
movement synthesis program



connecting max to the world
project documentation

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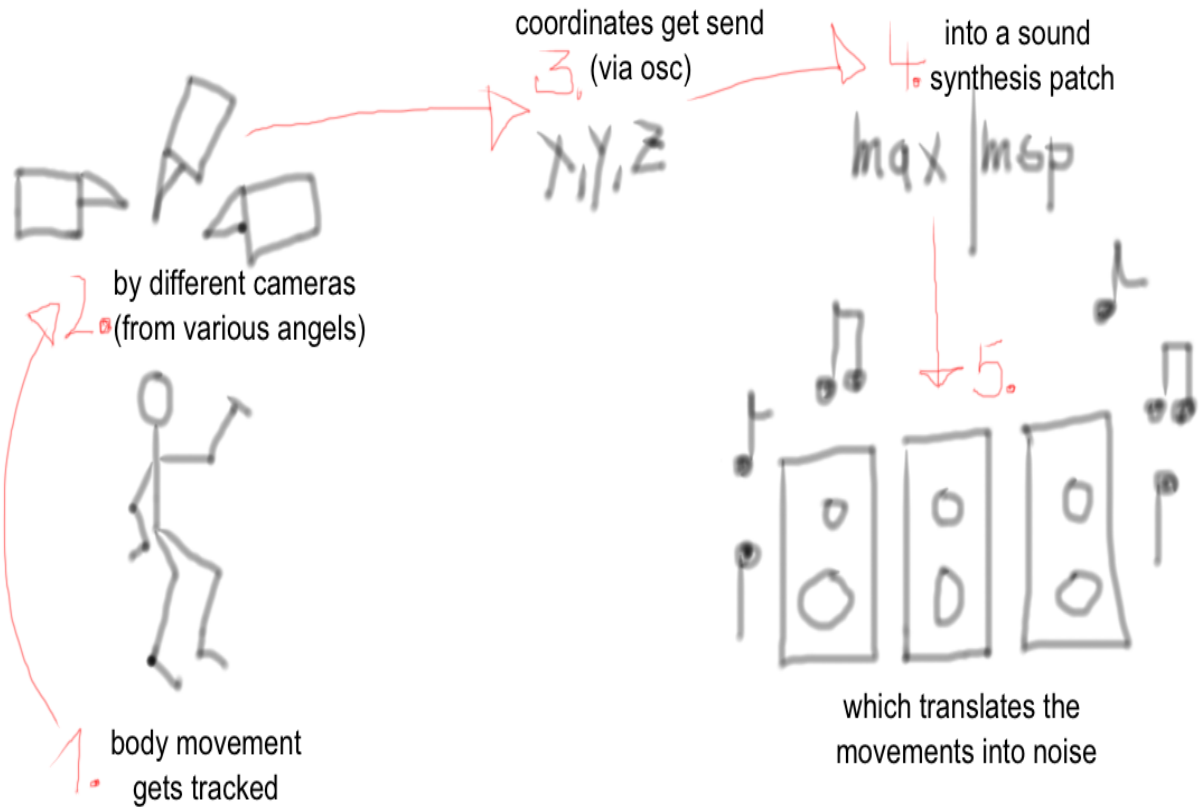
a) Introduction

The project "movement synthesizer" is a sound synthesis program that gets controlled by the human body. It is an application which enables the user to transform their bodily movements into sound.

Many parameters can be controlled and affected through tracking movement of various different body parts. It is possible to alter the pitch of voices, rhythm as well as several effects such as delay, filters, envelopes, amplitude etc.

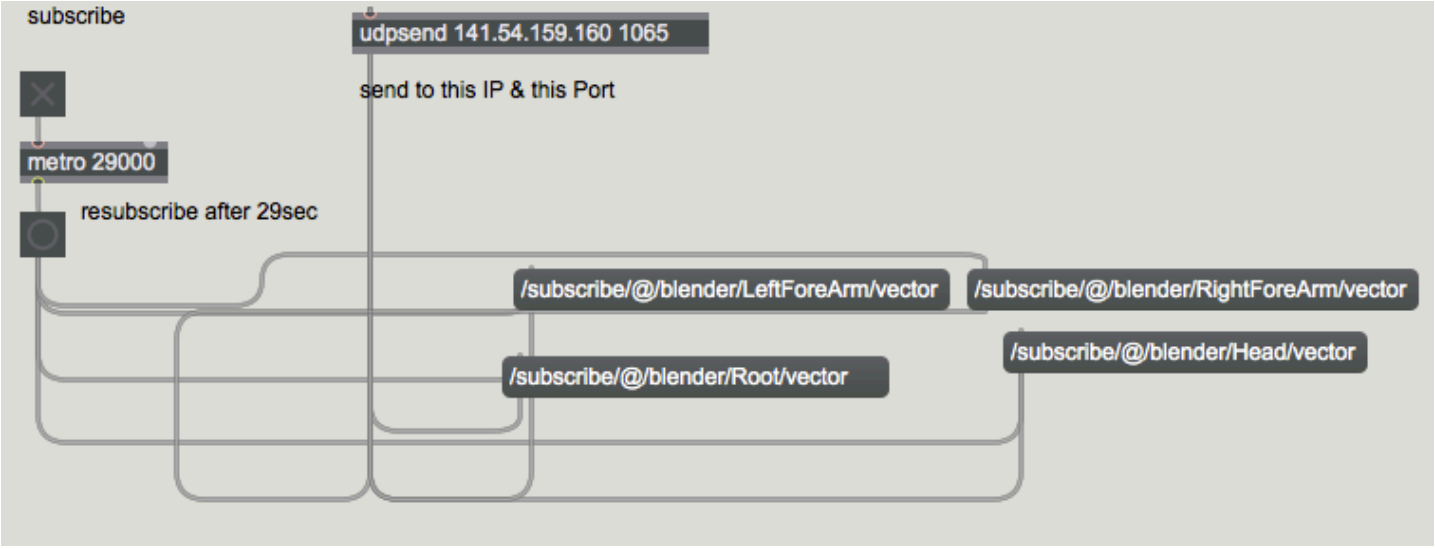
This project can be understood as an attempt to create an invisible, interactive application which translates bodily movements into sound. It is an aim to create a user experience in which the human body gets immersed into an invisible instrument. This fusion of organic matter with technology should be executed in a playful manner which encourages the user to playfully linger in and test the application.

b) diagram to describe functionality



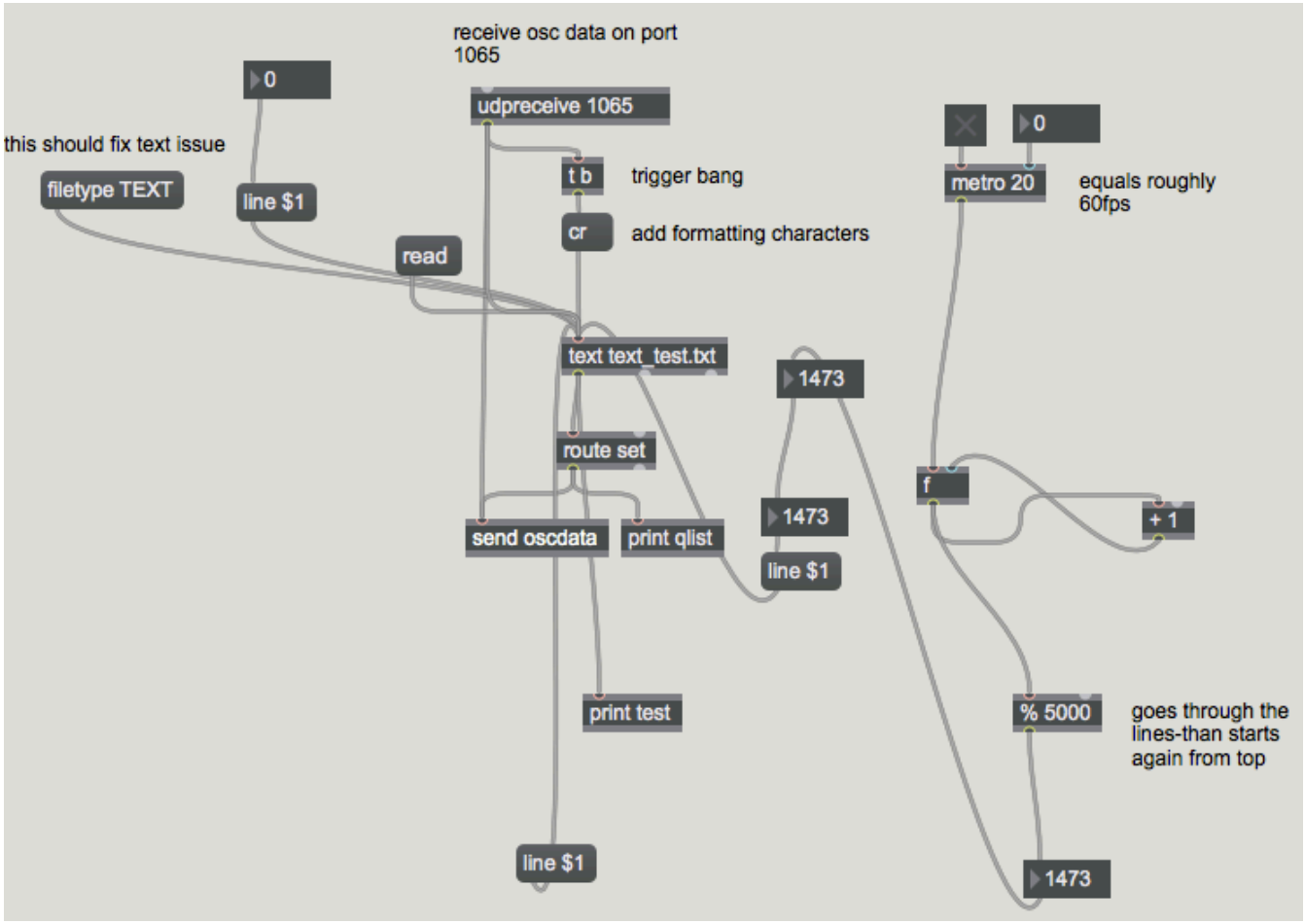
c) functionality description of movement synthesis program / compositional thoughts

The synthesizer has been built in the programming framework max/msp. For better overview the patch is broken down into three smaller patches which are named according to their functionality.



connector

this patch connects four body parts (head, root, left fore arm and right fore arm) of the captury with the framework max/msp via osc protocol).



player

this patch enables the user to review the sound of their movement after the real time session has been terminated.

```
/@/blender/LeftForeArm/vector -745.139 146.273 -1106.009\
/@/blender/RightForeArm/vector -863.556 576.343 -1085.682\
/@/blender/Root/vector -824.722 324.834 -934.118\
/@/blender/Head/vector -785.414 373.797 -1480.871\
/@/blender/LeftForeArm/vector -729.928 149.236 -1109.482\
/@/blender/RightForeArm/vector -842.990 578.532 -1089.231\
/@/blender/Root/vector -806.540 326.281 -938.107\
/@/blender/Head/vector -767.489 376.087 -1485.050\
/@/blender/LeftForeArm/vector -729.928 149.236 -1109.482\
/@/blender/RightForeArm/vector -842.990 578.532 -1089.231\
/@/blender/Root/vector -806.540 326.281 -938.107\
/@/blender/Head/vector -767.489 376.087 -1485.050\
/@/blender/LeftForeArm/vector -723.318 151.389 -1109.327\
/@/blender/RightForeArm/vector -831.831 580.324 -1091.161\
/@/blender/Root/vector -797.900 328.779 -939.258\
/@/blender/Head/vector -757.331 376.236 -1486.439\
/@/blender/LeftForeArm/vector -713.107 152.213 -1112.040\
/@/blender/RightForeArm/vector -808.906 580.547 -1091.153\
/@/blender/Root/vector -780.785 331.607 -941.539\
/@/blender/Head/vector -742.099 378.085 -1489.004\
/@/blender/LeftForeArm/vector -713.107 152.213 -1112.040\
/@/blender/RightForeArm/vector -808.906 580.547 -1091.153\
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/@/blender/LeftForeArm/vector -710.287 151.038 -1114.097\
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/@/blender/Root/vector -760.747 336.443 -945.001\
/@/blender/Head/vector -721.431 377.719 -1492.727\
/@/blender/LeftForeArm/vector -701.063 155.616 -1114.476\
/@/blender/RightForeArm/vector -775.290 581.917 -1094.384\
/@/blender/Root/vector -754.181 339.719 -945.844\
/@/blender/Head/vector -713.635 379.322 -1493.705\
/@/blender/LeftForeArm/vector -701.063 155.616 -1114.476\
/@/blender/RightForeArm/vector -775.290 581.917 -1094.384\
/@/blender/Root/vector -754.181 339.719 -945.844\
/@/blender/Head/vector -713.635 379.322 -1493.705\
```
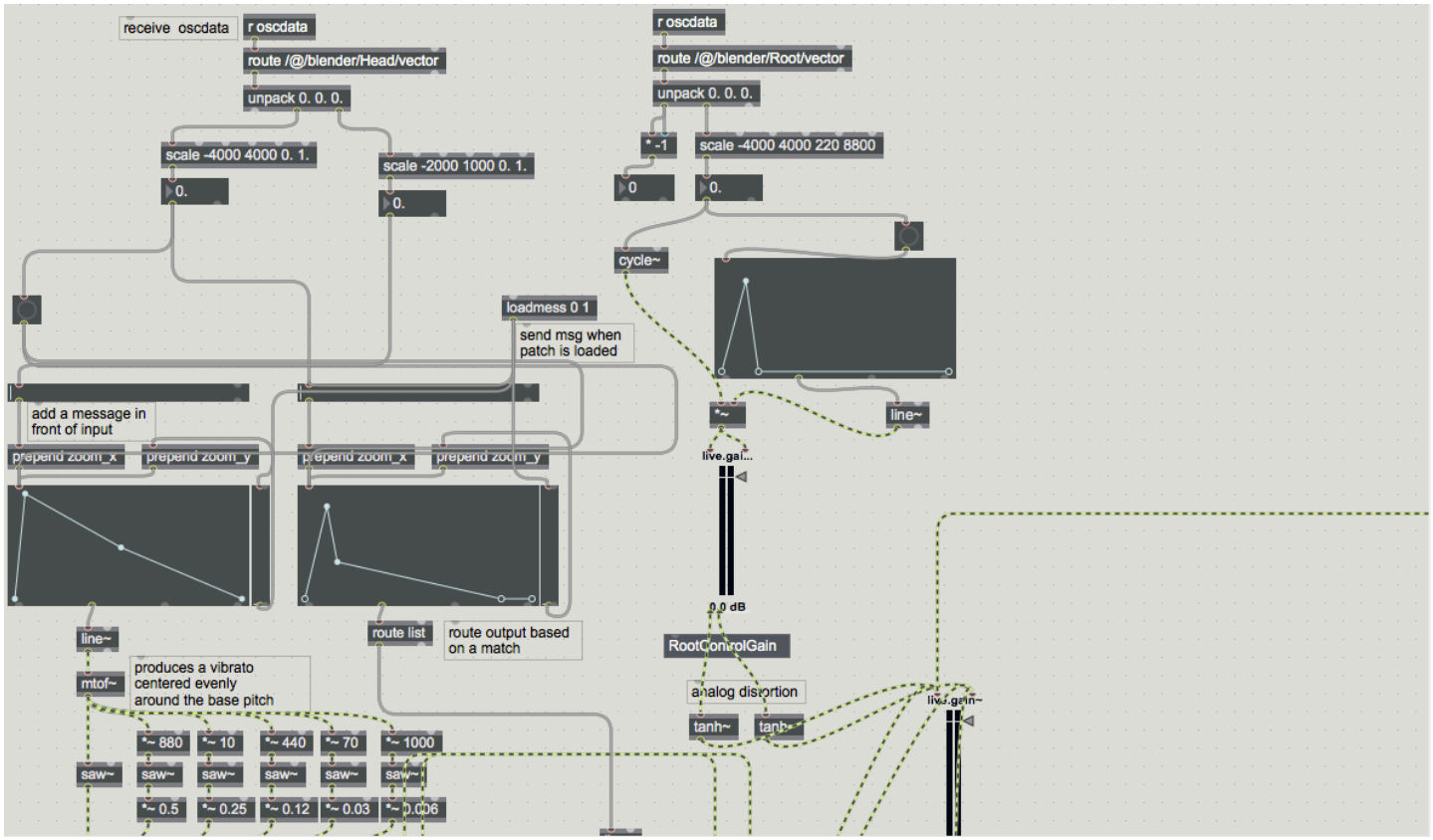
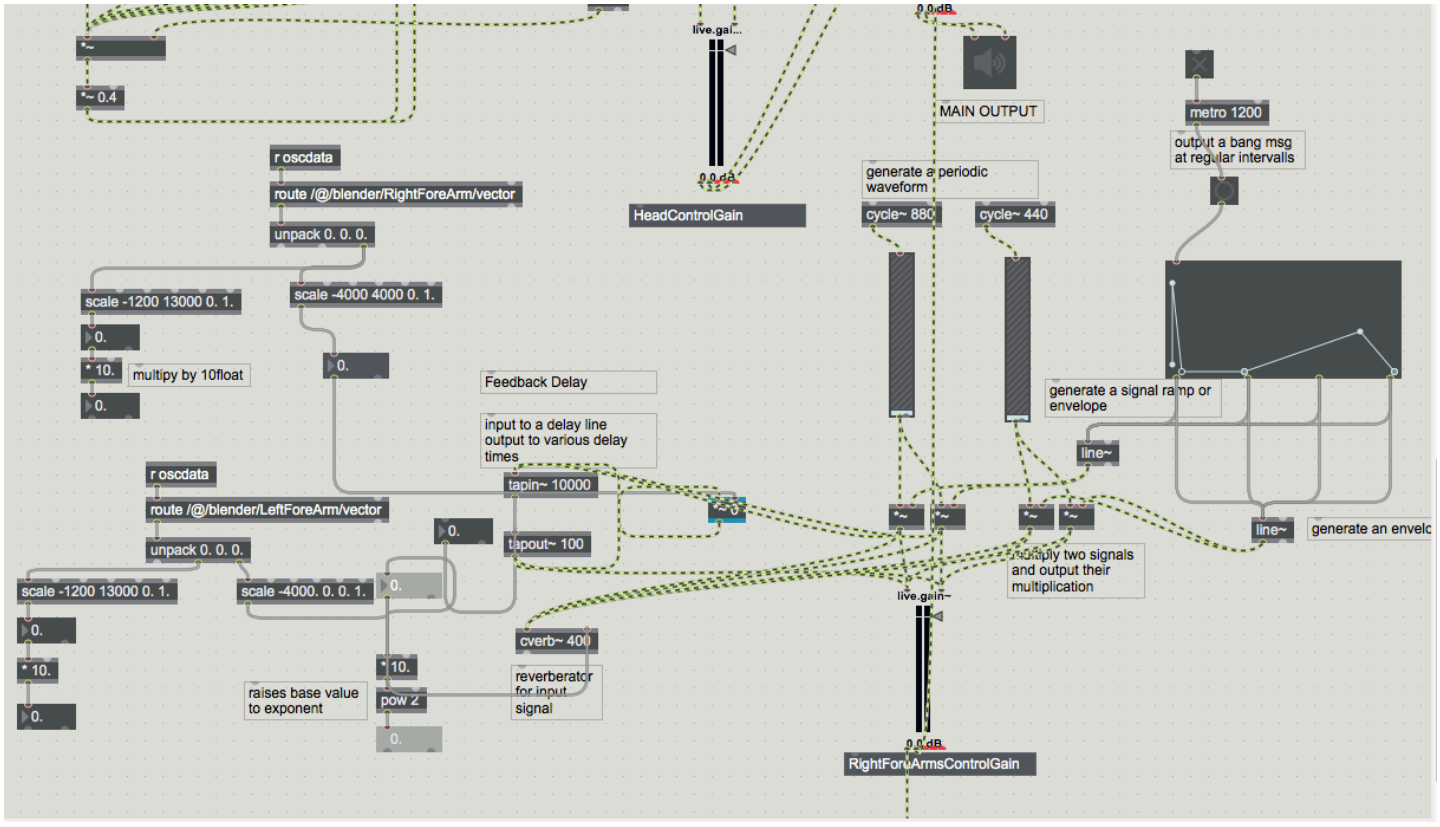

sample test text

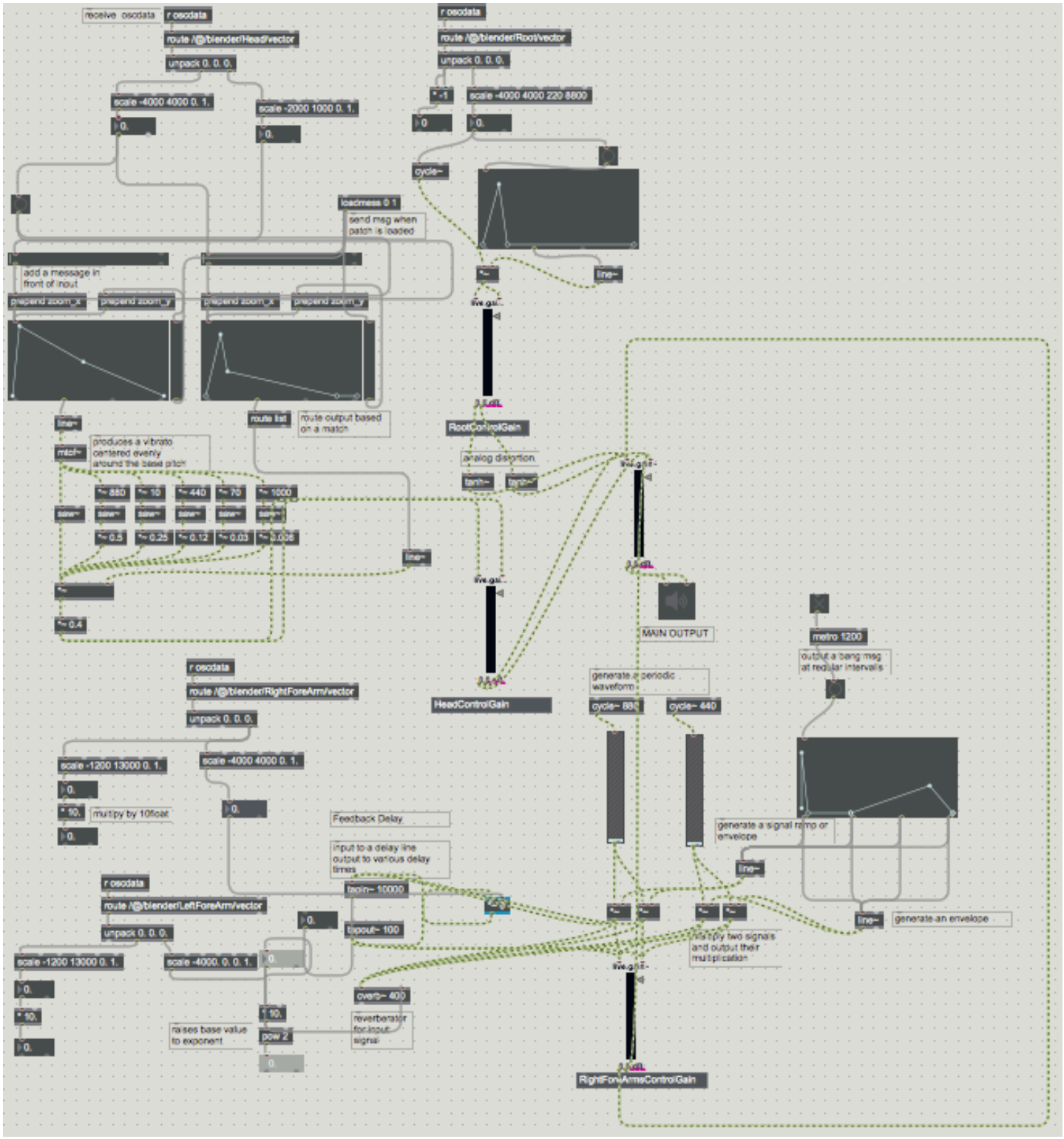
the data of this text shows in detail the movements of the four joints representing all axes necessary (so x, y, z) to be fed into the sound synthesis program.



noise generator 1



noise generator 2



noise generator

(entire patch)

how the sound gets controlled

The movement of the head, root and both fore arms control specific parameters of the synthesizer.

The position of the head gets routed through two different envelopes which perform signal rate midi to frequency conversion. The route output is based on a match found in these two envelopes. This produces a vibrato centered evenly around the base pitch. The root is linked to a sinusodial oscillator - the cycle~ objects to generate a periodic waveform which then gets filtered by another envelope. The left fore arm controls a reverberator and delay. A signal gets received and copied into a delay line. This object shares the same delay memory and can be used to create various forms of feedback. The data generated by the right fore arm gets fed into a ring modulator of periodic waveforms in which two signals get multiplied and outputs the multiplication into a signal ramp / envelope.

Detailed functionality of the instrument and it´s sound modulations can be checked in the comments of the noise generator patch.

d) tech rider

necessary technical requirements / equipment:

- tracking system of captury live and computer

- osc protocol

- max/msp framework

- different speakers for sound output

- a dancer

e) detailed description of the idea, the design and the prototype at hand

Inspired by gesturally controllable music instruments such as for example the Theremin I wished to build a sound synthesis program which immerses the human body with the instrument at hand. The aim was to develop a tangible interface in which tangible would describe the linked connections of body movements that generate, modulate or control certain parameters of the soundscape. I wished to create a setting in which probands could easily and in a playful manner create certain musical compositions in direct reference to their movements or at a later point to their developed choreographies. I would like to see people being able to make direct links and connections between their movements and to create an understanding and learning experience in which encourages users to develop their own musical pieces by learned behavior (i.e. certain movements of body parts alter the sound in a very specific way). Here we can make the connection to the term muscle memory through which the user does not necessarily need to recall the noise alterations on a cognitive level but rather through remembered choreographies stored in the memory of their own body. I would like to research if such an intuitive setting would facilitate a longer lingering of the user within the interface and if it creates a more playful manner of interaction and experience. The aim of this sound synthesis program at hand is meant to be easily, intuitively understood by the user and imply a correlation between movements of (certain) body parts, the velocity of the movement, gestures and their direct and immediate alteration of the soundscape.

To really get insights to these questions it would be necessary to conduct user studies to judge the experience design of this prototype. Feedback of probands then could start an open dialog in regards to usability, experience design, sound coding and so forth.

f) ideas for improvement of future works

The aim of this project has been the realisation of the idea as described in the diagram. It took four body parts which got connected in real time via osc to a sound synthesis patch in the programming framework max/msp. Main focus has been to develop a technically working environment of patches for further development. In the

future it could be possible to integrate more body parts and link them to specific sound output. The goal would be to create an environment for the user in which they can immediately understand in which way they are able to control or influence the different parameters of sonification. I would like to create an environment in which the user will engage in a playful manner with the aplication and feels encouraged to experiment with different effects. This could be achieved by a specific set up of various modulations; for example to assign a carrier frequency to the velocity of the head, assign effects such as delay to one, amplitude to the other arm; the feet could control the output of subwoofers and certain body parts could be assigned to buffers which hold a specific sound file.

I would like this project to be understood as a first, rough set up to this idea, which certainly deserves much more tweaking and more specific effects in order for it to become an application which outputs a soundscape generated by movement in real time with an intereting twist and one that certainly gives off the feel of an innovative instrument. Also the way in which the sound gets put out to different speakers and therefore in which way it travels through the room still has to be developped.

g) conclusion

Regarding the efforts of previous months I can conclude that, up until this point, it has been possible to achieve a technically working set up which connects four different body parts of the tracking system to an interactive sound synthesis program via osc protocol.

The main effort in the future will be to adjust different sound parameters in a way that enable the user to immediately grasp which movement controls which specific effect and the way it correlates with the entire body movement and it´s placement in space right from the get go. I am considering a carrier frequency which could be modulated by the velocity of the head, filters and delay for the arms. It will take detailed work of scaling to establish a composition which will be enticing and interestingly refreshing for the user´s ears.

h) summary of project submission

Sound:

- max/msp patches (commented):
- player patch + sample text file for testing purposes
- connector patch
- noise generator patch

Appendix

Sources / Inspiration

related topics:

Virtual Gesture Control of Sound Synthesis: Analysis and Classification of Percussion Gestures:

https://www.researchgate.net/publication/233711675_Virtual_Gesture_Control_of_Sound_Synthesis_Analysis_and_Classification_of_Percussion_Gestures

INTERACTIVE PHYSICAL DESIGN AND HAPTIC PLAYING OF VIRTUAL MUSICAL INSTRUMENTS:

https://core.ac.uk/download/pdf/51945515.pdf

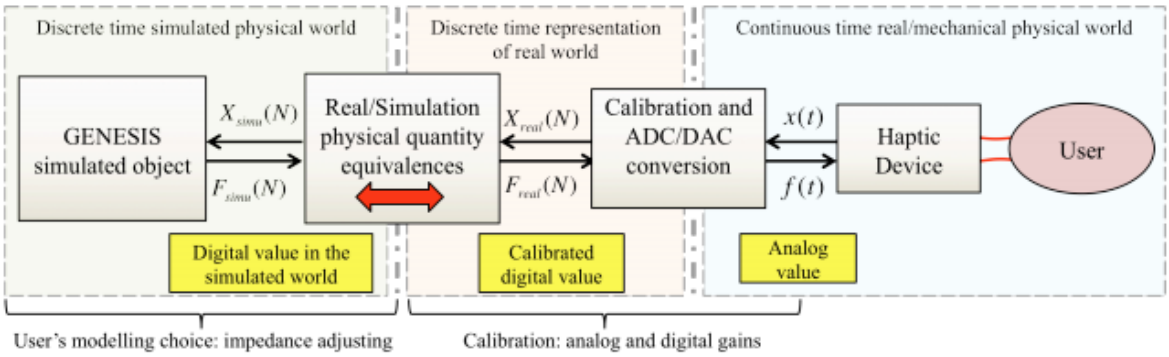


Fig 4. From the user to the simulated object: the full real/simulation loop.

Moving Imagination: Explorations of gesture and inner movement:

https://books.google.de/books?id=Cw2kp1OcAokC&pg=PA107&lpg=PA107&dq=movement+to+sound+transformation+examples&source=bl&ots=gkVhEXj2Qi&sig=ACfU3U0MIFPoSGZ8nnxHcp_jH_6WEXQ5VA&hl=de&sa=X&ved=2ahUKEwjxwPiL5InhAhVQ16QKHU7uAtUQ6AEwBnoECAgQAQ -v=onepage&

Sound Transformations in Electroacoustic Music:
(A simple framework for categorizing sound transformations: a 'parametric' approach)

https://www.composersdesktop.com/landyeam.html

Sound Energy Workshets:
https://www.pinterest.com/pin/280067670555670440

Sound Waves:
http://digitalsoundandmusic.com/chapters/ch2/

Manipulating and Controlling Sound:
https://spectrum.ieee.org/computing/software/manipulating-and-controlling-sound-the-development-of-acoustic-metamaterials

Sound Choreography <> Body Code:
https://www.tandfonline.com/doi/full/10.1080/10486801.2017.1343244?scroll=top&needAccess=true

Choreographie des Klangs – Zwischen Abstraktion und Erzählung:
https://books.google.de/books?id=p2tuCQAAQBAJ&pg=PA366&lpg=PA366&dq=how+to+transform+choreography+to+sound&source=bl&ots=uTT6V5Bhb5&sig=ACfU3U3GYNCtJA98eelY8qlTjCB2yg3vgQ&hl=de&sa=X&ved=2ahUKEwimwdO96InhAhUQy6QKHaOkCa8Q6AEwAXoECAgQAQ - v=onepage&q=h

Tech Tools to Transform World of Dance:
https://www.dancemagazine.com/36988-2307060178.html

Playable Bodies: Dance Games and Intimate Media:
https://books.google.de/books?id=UncLDgAAQBAJ&pg=PA95&lpg=PA95&dq=how+to+transform+choreography+to+sound&source=bl&ots=TX2SYzZF2B&sig=ACfU3U3mQeKu0fcDEvil6bxXsfXZaHP-LA&hl=de&sa=X&ved=2ahUKEwimwdO96InhAhUQy6QKHaOkCa8Q6AEwBHoECAUQAQ - v=onepage&q=how

A Choreography of a Spatial Sonic Disembodiment:
https://www.dmu.ac.uk/documents/technology-documents/research/mtirc/sssp0901wijnans.pdf

Dancing With Interactive Space:
https://contemporaryarts.mit.edu/pub/dancing-with-interactive-space

Consuming Dance: Choreography and Advertising:
https://books.google.de/books?id=foJZDwAAQBAJ&pg=PA65&lpg=PA65&dq=how+to+transform+choreography+to+sound&source=bl&ots=TpDTGMbsxT&sig=ACfU3U194vxaP3rH0VbEJCBrjx7W8GSLLQ&hl=de&sa=X&ved=2ahUKEwimwdO96InhAhUQy6QKHaOkCa8Q6AEwB3oECAMQAQ - v=onepage&q=how

CHOREOGRAPHY OF SOUND – BETWEEN ABSTRACTION AND NARRATION:
http://www.cosound.de/en/curators

Artistic director of renowned movement arts school explains the science of dance:
https://www.indiatoday.in/education-today/gk-current-affairs/story/science-of-dance-healing-jayachandran-palazhy-interview-1290055-2018-07-19

Humans and Algorithms Dance Together:
https://www.vice.com/en_us/article/yp53d5/humans-and-algorithms-dance-together-in-this-interactive-performance

Post-Truth and Beauty | This floating World:
https://timmb.com/