DIY Audio Design

Building and designing your own sonic tools.

Alexander Bolk August 2011

Supportive narrative for the partial fulfillment of the
Master of Arts in Creative Design for Digital Cultures

Sound and Music Technology
Hogeschool voor de Kunsten Utrecht
Faculty Art, Media and Technology

Oude Amersfoortseweg 131
Postbus 2471
1200 CL Hilversum
035-6836464
info@kmt.hku.nl
kmtweb.hku.nl

Supervisor: Jorrit Tamminga
Student number: 2061348

MADDC
MA DESIGN FOR DIGITAL CULTURES

Utrecht School of the Arts

Contents:

1 Introduction **6**

2 DIY music technology 7
- 2.1 D.I.Y culture . . . 7
- 2.2 evolution through revolution . . . 8
- 2.3 personal background . . . 10
  - 2.3.1 modification. . . . 11
  - 2.3.2 kits and patches . . . 13
  - 2.3.3 circuits . . . 14
  - 2.3.4 software design . . . 15
- 2.4 So, what is possible as a diy sound designer? . . . 16

3 From modification to design **20**
- 3.1 circuit bending . . . 20
- 3.2 modification . . . 22
- 3.3 effect pedals . . . 22
  - 3.3.1 history. . . . 23
  - 3.3.2 fuzz . . . 24
  - 3.3.3 modulation and delay . . . 25
  - 3.3.4 experimentation . . . 26
- 3.4 sound generators . . . 28
- 3.5 software solutions. . . . 30
  - 3.5.1 software prototypes . . . 30
  - 3.5.2 software controllers . . . 31
  - 3.5.3 hybrids . . . 32

4. Applied tools and techniques **33**
- 4.1 sound design. . . . 33
- 4.2 signal theory . . . 33
- 4.3 electronic engineering . . . 34
- 4.4 soldering . . . 34
- 4.5 programming . . . 35
- 4.6 interface design . . . 36
- 4.7 artwork . . . 37

5 Evaluation **38**
5.1 results 38
5.1.1 circuit Bending 38
5.1.2 modification 41
5.1.3 effect Pedals 42
5.2 external review 46
5.3 tools 47
5.4 techniques 48
5.5 failure and improvement. 49

6 Conclusion and future work **51**

Bibliography **53**

Appendix A Links **55**
Appendix B Interviews **57**

Abstract

This text is a description of the author's endeavors and research into building musical tools and instruments with a so-called D.I.Y. approach. The projects and this text are part of the fulfillment of the EMMA program at the Hogeschool voor de Kunsten in Utrecht.

The first chapter gives a brief definition of DIY culture within the context of the author's projects and states his project goal and research question:

- What are the possibilities with diy as a professional sound designer?

In order to become a competent professional, it is essential to improve skills in arts and crafts, design, signal theory, math, physics and electrical engineering.
Documenting how much improvement and skills can be developed during the course of these projects and interviewing several peers, the main motivation for the subject is a longstanding interest in the diy culture within music technology.

Chapter 2 outlines the work-field related to the subject of diy music technology and gives a brief overview of the author's background.

Chapter 3 presents the world of diy in music technology today and some of it's history and illustrating the possibilities and advantages of diy opposed to the consumption of music technology.

In chapter 4 the required techniques and tools for the projects are summarized.

Chapter 5 evaluates the projects and progress made by the author in relation to the research and interviews.

The final chapter looks back at the complete project and will answer some of the problems encountered in the practical work, suggest improvements for future work and assess the author as a professional in the field.

In the appendix will be transcriptions of a number of the interviews done for the research and a list of resources and links for further reading.

1. Introduction

D.I.Y. means 'do it yourself'.
Taking control of processes that used to be done by others, diy can be improving, repairing and cloning existing technology, but most important to this text, diy means innovation.
From folding a piece of paper to support a wobbly table, to a rocket built in your shed, diy is wherever technology and science is used and it is, and has always been part of our lives and it will be the most relevant part of our lives in our technology dependent future.
Before the industrial revolution we applied technology the way we diy today. Civilization depended on arts and craftsmen and the economy thrived on trading technologies and goods.

As we evolved into the industrial revolution we became less dependent of arts and crafts, but more and more on industrial processes and storekeepers.
The 20th century saw this revolution blossom into the world we know today, we live in a world where everything is connected by industrial and globally controlled processes, all powered by western world economy. When a developing country gains economic significance, within the list of third world countries we categorize them as 'newly industrialized country' ! (Toffler 1980)
The first and second world war forced electronics and industrial science and technology forward. We became extremely advanced in only a few decades and after the second world war we were left with a brave new world of consumer electronics, highways, television and consumer marketing. All this helped to shape music technology as we have it available to us today.

With the arrival of the internet we started a new revolution and today, almost 30 years later, we start to see the consequences on technology and the world we live in.
DIY culture is an internet community sharing their work and knowledge through various websites and media outlets on the world wide web. Remember the trading of arts and goods and technology..
Because we have everything available to us all the time, instantly. We are left with few restrictions, than money. But most of the significant innovations of the past were not motivated by money. So although we have large quantities of diy projects and communities, ground breaking work is scarce.

My goal is to look into the world called diy. By being part of communities within music technology, investigating what motivates the participating people. To see what future and impact these communities can have as a whole in a world driven by fashion and mass consumption, rapidly changing. Everyone is now part of the internet, and the social aspect is being formed and combined with technological development and sharing of knowledge we are creating a culture that is very similar to the world before the industrial revolution. Accelerated and virtual, but very similar. I hope to get a clear picture of what is possible as a diy sound designer.
How do we use this new world, what can we do ourselves, as individuals and benefit from the seemingly limitlessness of it all?

2. D.I.Y. music technology

2.1 D.I.Y culture

DIY is a broad term and so is 'diy culture' it expands from home improvement far into every field of arts, crafts and science. There are however similarities to the way various forms of DIY evolved within society over the past century and how common influences such as technological advancements and the digital revolution brought a lot of them together and with the recent decades of online sharing, diy has generated culture. (handmade nation, the rise of diy, art, craft and design 2009)

With the greatest library of all available to us we now have access to information on all of those developments, from the past to present. There is enormous potential, but also a very negative and chaotic side to the information highway. It can have an impact on your judgement and make you less objective to a product's qualities.

In electrical engineering we have data-sheets available to every part we can imagine, schematics on most equipment available to us on the market. So without any undiscovered territory out there it becomes very hard to use your imagination without a feeling you do it out of a necessity to be original. When it comes to actually making an honest living on the internet, the lacking of regulation and rules and it's chaotic nature can makes it a lot like gambling. You can have a hit or great success with the least effort and you can have your work float around there unnoticed. The only rules that seem to apply to how the internet behaves can be found in the study of chaos. (Lorenz 1993)

But out of chaos comes order and in the case of art, a lot of beauty and data can be extracted from it. So as a community a group of DIY artists and individuals can truly make an impact and a successful business. (see the interview with Tom Dalton of fuzzhugger effects, which is an example of the above statement.)

An important difference between a commercial product and a diy product is it's initial goal and the impact they have on the music community.

"One is moving products, one is defining culture"

- From the documentary 'I need that record'

2.2 evolution through revolution

Music technology changed rapidly since the second world war left us with accelerated developments in communication and electronic engineering. From radio-waves and tube amplification, we entered the 1950's with tape recorder and transistors and we are still basing most of our recent work on the basic principles of those inventions. (http:/obsolete.com/120years.com) And with current developments in surface mount electronic parts, we are limited to aging techniques and parts for our electronic designs, for it is simply to complicated to stay up to date technically, yet this doesn't mean our designs are aging or not competitive with the current mayor companies' line of products.

This development of SMD electronic is an example of an evolution that does not necessarily benefit the DIY sound designer, for it limits their technical capabilities against the commercial technological standard. However the limitation and current retro popularity of instruments, sounds and techniques from the past can be seen as an advantages and a chance to redesign not only good designs from the past, but also make them available to a younger market. (From the interview I did with engineer and electronic instrument designer Maarten Halmans:)

"...in the longer future it will become harder for a lot of people, thru hole technology(electronic components with leads) is becoming obsolete and and most electronic parts will be surface mount. This makes it harder to get started in diy because of the needed soldering skills. On the other hand it will become easier and cheaper to do small runs of specific semiconductors and electronic instruments."

An accessible and relatively easy form of diy design is cloning existing technology. Schematics and often layouts for circuit boards are available to a lot of equipment, you can start building your own ssl compressor (http://www.gyraf.dk/gy_pd/ssl/ssl.htm) or serge modular synthesizers (see the interview I did with Jon Nensén) and while doing so you'll get a better understanding of how those original designs worked and why certain decisions were made in the design process. So cloning is a rewarding way of learning and it leaves you with a useful collection instruments and tools. What should you clone and what not is up to you, it can sometimes be a long and expensive road, making buying an easier solution. It can also give you an opportunity to build something of better quality or more suited to your specific needs.

A subject close related to my projects is the cloning of guitar pedals. There are numerous clones and most pedals are based off older schematics. A lot of effect pedals, or often called stomp boxes, follow similar rules for their design, input to the right, output to the left and a foot switch on the lower middle. With a bit of imagination a pedal can be seen as a face, hence the name of a famous classic effect pedal, the fuzz-face.

Here's an example of a clone almost identical to the original, a 1966 Sola Sound Tone Bender mkII, remade by DAM audio for Sola Sound (http://www.stompboxes.co.uk/History.html) almost 40 years later:



fig 2.1 original sola sound tonebender mkII (picture from stompboxes.co.uk)



fig 2.2 cloned sola sound tonebender mkII (picture from stompboxes.co.uk)

Copyright laws and the information highway are currently clashing on a lot of fronts. We have seen how Napster (Hart 2001) changed the world of music sharing and inside the small world of diy stomp boxes we are seeing similar things happening. A person's creation is his, but today his creation can be bought, taking apart, photographed, shared online and cloned by hundreds of others. The patent rules that apply for technical inventions often don't apply, for a pedal already being a version of something existing. For example a chorus and echo are variations of the same type circuitry, a delay. And where does a variation of it become your own design? A completely new research could be done to answer that question, but for this paper it is sufficient to state my point of view. A max patch is still a variation of max, not a completely new piece of software and I believe I can make money out of labor, art and design, and that design part of the income is only possible if I am part of, or responsible for the design. For personal use and fun I believe we should be free to copy and clone whatever we have available. It is all a part of the rapidly developing public domain for our work, the internet. A subject too vast and complex to discuss in this paper.

2.3 personal background

Is was always intrigued but also very impressed with anybody who could build something . I never had a background in engineering or mechanics, but learned a lot over the years. Never have I felt pressure to achieve a skill level or build something, this helped me a lot in developing the basic skills and confident to design things today that are to a standard that is acceptable not only by myself, but by other musicians and artists. Good work takes a lot of time and patience is a virtue.
I got into electronics when someone traded me a '*bent*' drum machine for an old broken mixer and it got me started with *circuit bending* my own noisemakers and toy keyboards. and using them live and in the studio.



fig 2.3 my performance setup, including the 'bent' Casio SK1 (by Sabine Bolk. Breda 2008)

I learned to appreciate and enjoy building things for my work as a musician and sound designer. Every year I see a progression in my work and am happy to now also see others enjoy my creations and solutions. There is still a lot to improve, but over the course of this research I have gotten a much clearer view of the road I should take and what the next steps are to progress further in the world of diy. From circuit bending and building an 'atari punk console' six years ago, I feel I have already come a long way.

2.3.1 modification

The first period of circuit bending for me meant learning basic electronics and I improved my soldering a bit and started to feel comfortable opening toys and working with electronic parts. For my next project I had to choose between buying and or doing it myself, I needed to buy an electric guitar. It shouldn't be too expensive, it should be versatile and be good enough to practice and record with. From the pickup to the shape of the guitar, I researched everything and constructed a picture in my mind.

My budget was set around €300 , I couldn't find a guitar that would suit all my needs for that budget, but what if I bought an ever cheaper guitar and modify it?

For half my budget I bought a second hand korean make 'Squier stratocaster'.



fig 2.4 fender squier stratocaster

I started playing it and learned it's sound. I started researching everything I could find online on guitar improvements. The Seymour Duncan website provided basic wiring diagrams for most common configurations of a guitar. The squier as it was didn't impress me much, but it's potential blew me away. For the next 6 months I started to work on the guitar, changing everything I could and experimenting along the way. I learned how to browse the right forum for the right information and plan ahead for every modification.

I changed the tuners, the pickups and configuration, the body-plate and all the electronic parts. And the best improvement of all, I properly shielded it with a Faraday cage.

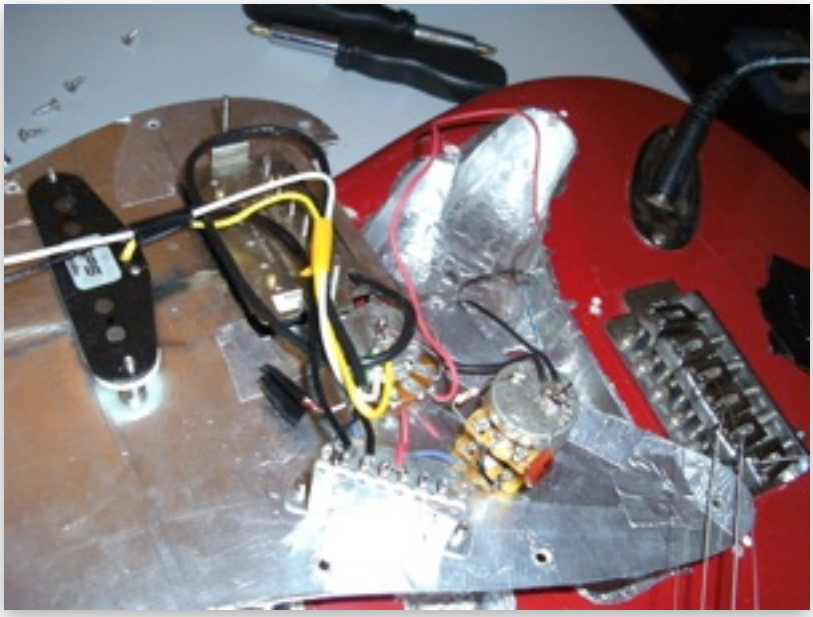


fig 2.5 new and modified electronics

The results were good, the guitar was silent, stayed in tune, had a great sustain, pickup settings from a creamy sounding neck pickup to a loud humbucker bridge pickup and it had a useful single tone-knob, capable of shelving treble or bass off the signal.



fig 2.5 my main guitar, I still play today

I couldn't be more satisfied and I've spent almost the same I would on a second hand guitar of similar quality. An additional bonus to the hours of work I've put in, is that I now know how it is wired and it is much easier to repair or further modify in the future.

2.3.2 kits and patches

All my circuit bending and work on my guitar was done by ear, I used internet references and simple drawings as guidelines and just kept experimenting till things worked.
Doing that for a few years gave me a lot of basic knowledge on how these circuits work and how to look at them.
Last year I redid a lot of soldering and improved my guitar and some of my circuit bent projects to extend their life and use.
Besides circuit bending I was doing simple noisemaker kits (for example the 'wacky sound generator' by http://musicfromouterspace.com) and programming a lot of patches circuits on my computer in among other software, max/msp. (http://cycling74.com)

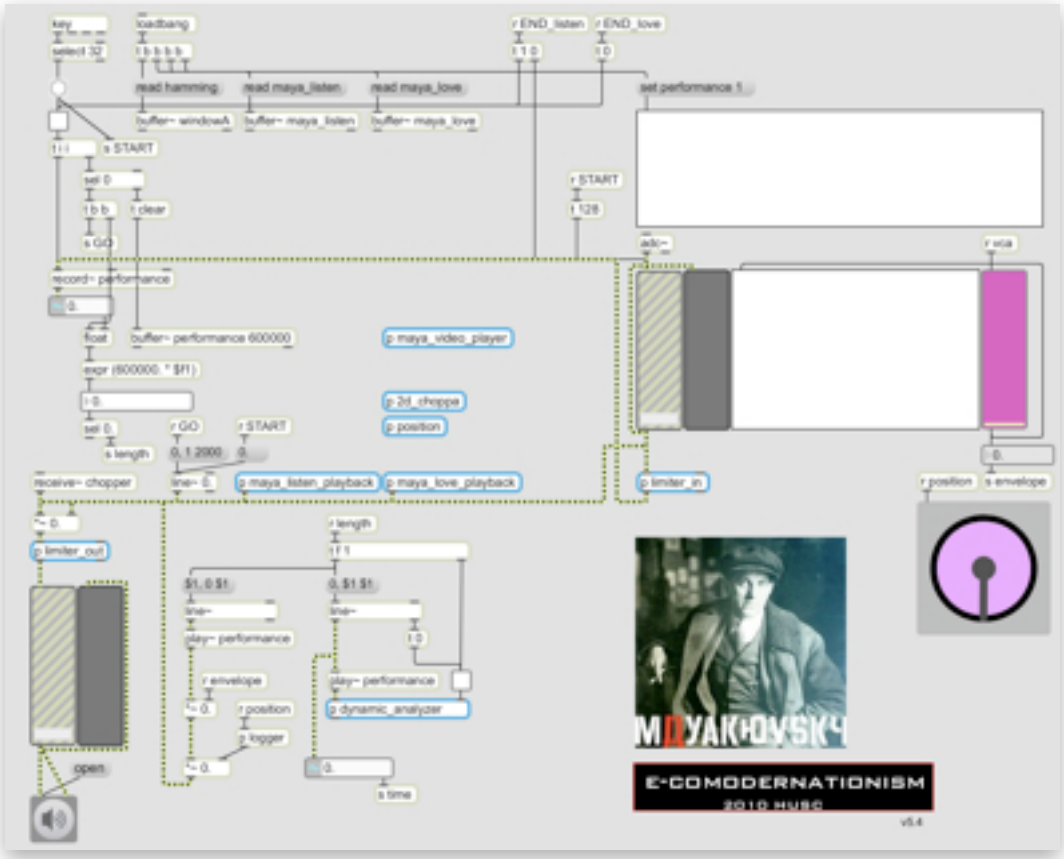


fig 2.6 A patch I wrote for our Mayakovsky performances, the patch generates video while transforming a live recording of us reading Mayakovsky's poetry and improvised clarinet.
http://www.youtube.com/watch?v=R5bnJu18BGs

Programming synths and patches and building kits opened my mind to new ways of thinking about technology, over the years I went from using different types of gear to opening a lot of them up and researching how things work.

"Create your own situation, that you know the ins and outs of" Make magazine

Learning more about the technology I was using not only improved my skills in the construction and design of diy products, but it also improved the way I used the equipment in my studio.

2.3.3 circuits

My circuit bending has evolved and I focus more on interface design and artwork. I'm started to learn electronics and am building very simple circuits from scratch using perfboard and veroboard instead of pre made printed circuit boards.



fig 2.7 The Sammichsid synthesizer nearly completed without it's enclosure, a straightforward 'paint by numbers' type project that required nothing but patience, precise and accurate work.
(http://www.midibox.org/dokuwiki/doku.php?id=sammichsid)

Every successful build motivates me and helps me improve the next. You advance a lot of skills while working on circuits, soldering and reading schematics being the obvious, but there is also logics, efficiency, measuring, planning and research involved that will benefit me as an overall engineer.

Compared to the work I can do within a software environment, building up skills in hardware design sometimes feel like baby steps, but I noticed an overall understanding of sound and the way musicians and artists interface with sound comes from working and experimenting in both software and hardware.

2.3.4 software design

I spent a large deal of my education and internship working with software and creating software solutions for a performance and an installation. I was lucky to be part of a project where we built our own multitouch controller the size of a large TV. The project forced me into new directions, such as modifying a webcam for infrared viewing and writing software solutions to detect movement on the multitouch and eventually control music software with it. (I spent the first three months of 2010 as an intern working in a team for Looplala and Born Digital to construct the multitouch controller and it's software)

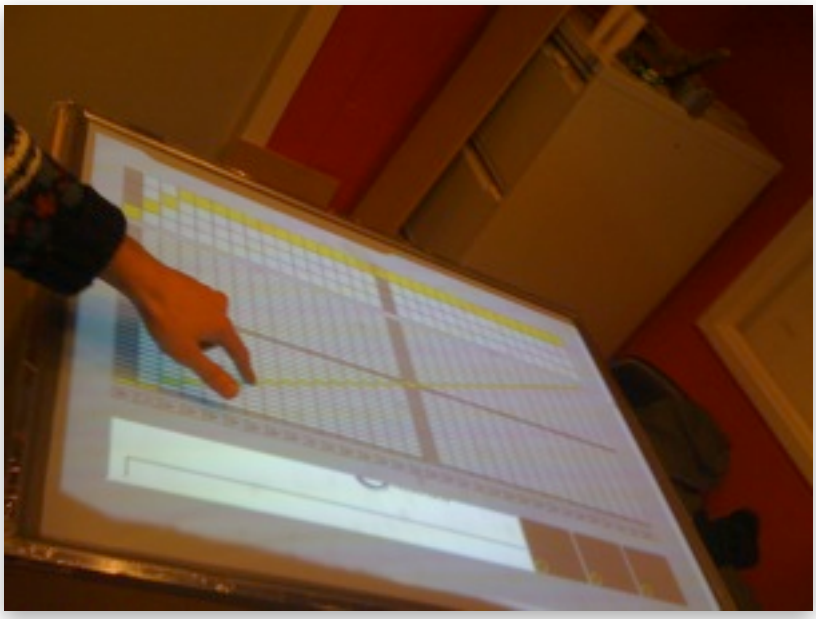


fig 2.8 The multitouch interface running test software in max for live.

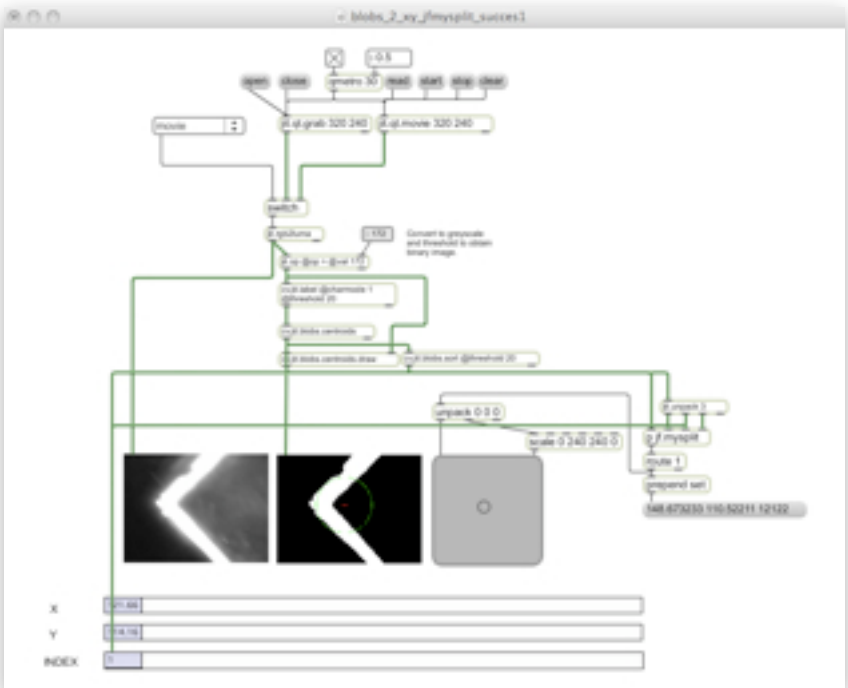


fig 2.9 Software prototype in Jitter for tracking fingers on the multitouch table.

2.4 So, what's possible as a diy sound designer?

In both soft and hardware design I am following a similar learning curve and every step is similar in both situations, but require different skills and methods. Where in programming one relies very much on theoretical knowledge of the material, in electronics one relies more on the laws of electronics. In both worlds, the more you advance on the ladder, the more sensitive your work becomes to error.
Circuit bending and creating presets can both result in unpleasant noise, and in the worst case scenario, your toy will burn out or you'll have a bad sound. Anyway, both can be seen as experimentation and part of an important learning curve. When it comes to repair and writing software, there is less room to experiment and the goal of your work becomes more and more clear. In the final stages you are most likely no longer working for your own benefits, but designing and building for other users. Interface design, bug free software and clean and professional work become more important than the actual sonic exploration.

hardware:	software:
1. circuit bending	1. creating presets
2. modification	2. using and modifying software
3. kits and repair	3. writing patches in open source software environments
4. building and combining simple circuits	4. writing (open source) software environments
5. complete design of an electronic device	

These two rows represent the progression I feel I can make as a diy sound designer in both hard- and software design.
I want to give two examples, the Midibox community and Rob Hordijk Designs, of a successful completion of the above described progress.

http://www.midibox.org/

Midibox is a open source community designing and building synthesizers and midi controllers, building on early experiments by Thorsten Klose, the community now delivers about 16 separate modules, among them micro-controllers, sound modules, midi I/O modules and some users provide full kits, where a selection of modules are pre arranged and offered with matching enclosure and hardware. The software is an open source and the community contributes to it's development at a speed exceeding for example the Korg kaosspad's software, which has only seen a single, unfinished upgrade.

The midibox community is also partly responsible for a lot of the exploration of the famous commodore 64 sound chip, the SID. I've built a sammichsid, which is a midibox synthesizer based around a SID module with two SID chips. It gives me full access to the chips sound capabilities and gives me midi and audio in and output on a studio quality level. The kit I bought came with everything I needed and the process of building it was easy and well supported by the designer on the midibox forum.

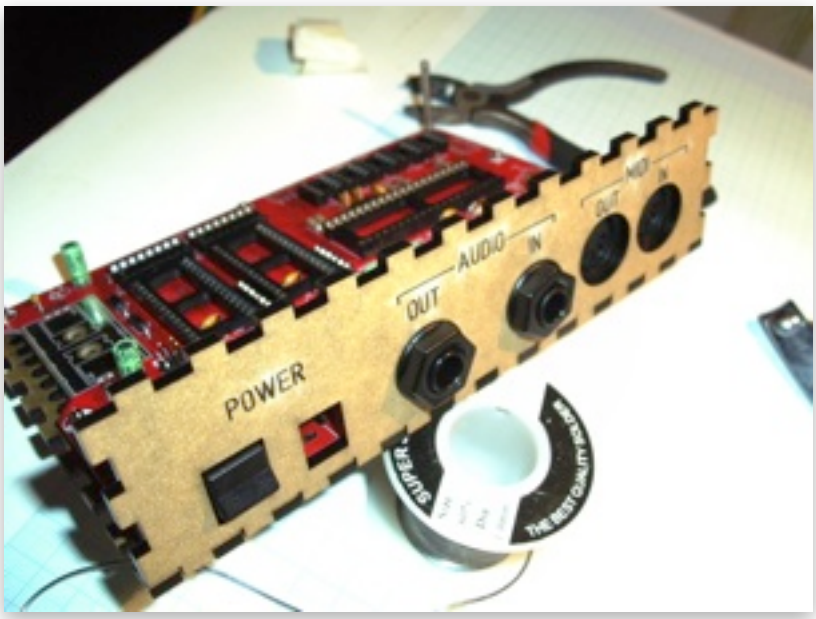


fig 2.10 The sammichsid synthesizer under construction.



fig 2.11 The sammichsid synthesizer, a powerful and productive part of my studio.

This is the first thing I built where I truly felt, I couldn't have bought anything that would've made me more content. I still use it a lot and am exploring the software editing capabilities, making it an even more powerful synthesizer.

In my research I visited Rob Hordijk to talk about diy and look at his recent work. He is a designer and artist who worked extensively in the software world, but is currently designing a range of synthesizer modules that truly amazed me. The synthesizer modules are bigger than the common Eurorack size for synthesizer modules, the knobs were very big and thus very musical. And the layouts of all the modules had a symmetry in it that made the collection of them together look calm and inviting.

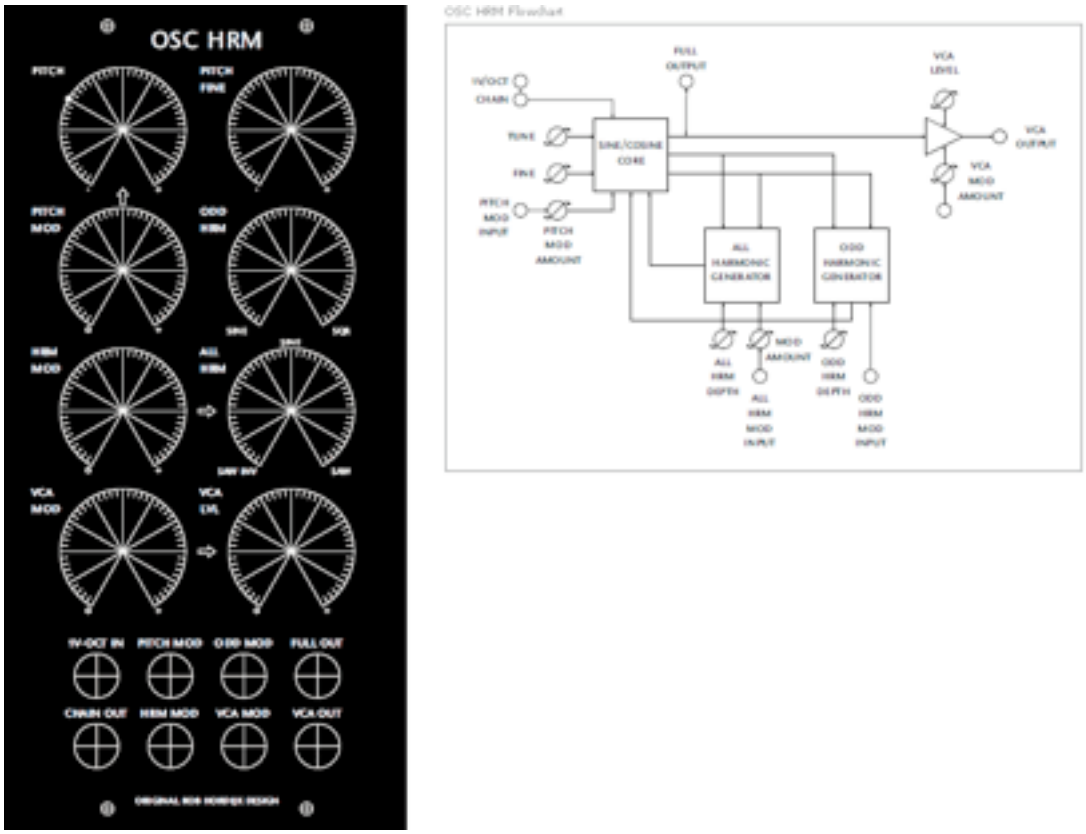


fig 2.12 The layout for the oscillator out the range of synth modules by Rob Hordijk. The simplicity and symmetry in the layout can be found in all modules and is an incredible competitive feature when constructing larger modular systems.



fig 2.13 Complete modular system of Rob Hordijk design modules in a customized flightcase.

Design at this level is where I feel you are capable of building your sounds and tools completely from the way up. A collection of useful modules with an enough connectivity and control to give you a career long sonic palette.
I believe he serves as a true example in the field of DIY music technology and am very inspired.

A good read for any sound designer are his synthesis workshops:
http://rhordijk.home.xs4all.nl/G2Pages/index.htm

More details information on his synthesizer modules can be found at:
http://wiki.muffwiggler.com/wiki/Rob_Hordijk_Designs

3 From modification to design

3.1 circuit bending

My first encounter with diy electronics was by being exposed to the realtime hacking of a small drum machine. The name 'circuit bending' sounded very intriguing.

Circuit bending is a term coined by Reed Ghazala and many other sound artists in the past 50 years. (Ghazala 2004) The Wikipedia entry defines it as:

"the creative customization of the circuits within electronic devices such as low voltage, battery-powered guitar effects, children's toys and small digital synthesizers to create new musical or visual instruments and sound generators."

I went home and destroyed a lot of sound toys and keyboards. Although not many useful results, musically nor artistically came from this short period of experimentation. I did gain an enormous boost in creativity and made a lot of headway on the path of trial and error, working with different electronic parts, circuit boards with nothing but your ears and ideas is the most inspiring of all activities that relate to my creations. And the confidence and basic engineering skills and crafts obtained along the way helped me in every project up until now.

Circuit bending is a form of hardware modification and online a lot of toys and particular 'bends' have been popularized and are considered and used as instruments in almost every possible scenario. From movie soundtracks [1] to sample libraries, to performance situations, the Casio SK1 is a machine that has been hacked and modified in numerous ways and can be seen online in all sorts of housings even with expanded interfaces resembling modular synth panels.



fig 3.1 Casio SK1 circuit bended into a modular synth.
By Peter Edwards of http://casperelectronics.com

[1] A circuit bent casio SK1 and other obscure toys and children keyboards were used by musician Michael Andrews to compose the score for the 2005 movie 'Me, You and Everyone we know'

The Texas Instruments ‘Speak and Spell’ circuit and the Furby are among many other famous ‘bent’ toys notable to mention.



fig 3.2 Circuit bended furby by OrminFactory

Circuit bending is no different from modification or even short circuiting and damaging circuits by chance, the more theory is applied the more it can be considered modification or even electronic redesign of a circuit. Circuit bending is, however, more than just the act of short circuiting, it is a community around a form of hardware modification that is in many aspects close related to the hacker culture.

“The hacker cyberculture .. it’s disaffiliation from a domestic parent culture is often manifest in activities that answer, directly or indirectly, to the legitimate needs of industrial R&D.” Kevin Mitnick, quoted in Strange Weather: culture, science and technology in the age of limits (Ross 1991)

And within this community circuit bending takes on larger forms and connects various art forms and aesthetics, making it a powerful statement and source of new art and music, and a to many artists open and new way to look at being creative. Also all my circuit bending had an impact on my lifestyle outside of music technology.
Through circuit bending I became more and more aware of recycling and I started to look different at garbage and disposable or broken objects. One man’s trash is another man’s treasure. It certainly is in circuit bending. I enjoy visiting thrift stores and second hand markets, not only hoping to find something useful, but also to be amazed at the materials, parts and beautiful things you can buy today. A lot of people are throwing away perfectly usable stuff, it can save you a lot of money and buying something already used forces you to work with pre designed interfaces or parts, which in a way forces you to use ingenuity and be creative.

3.2 modification

From replacing pots and parts in your equipment to replacing strings, every musician and engineer encounters the need to modify tools or instruments. Reasons can be improvement of sound, special effects and or searching for new sounds. To be confident and do modifications to a circuit without lowering it's original quality requires research into the existing circuit and the intended modifications.

The internet is a fantastic resource for such information, because modifications on many popular circuits and instruments are well documented and can redirect you to the required schematics, parts and their respected data-sheets to do a tested and often paint by number approach to a modification. This last metaphor also shows you clearly the difference between circuit bending and modification, the last being a calculated procedure with a desired result in mind. While circuit bending is often encountered by chance and working directly on active circuits, modifying them with whatever parts are available and judging their effect instead.

3.3 effect pedals

Building kits and circuit bending improved my practical skills, but did not give me enough theoretical knowledge to actually design and build my own circuits and devices. The desire to build my own things has grown over the years and I want to be able to build and design devices and instruments that would also be useful for someone else and make devices that are original and as useful as commercially available products. To get there I must start building slightly more complex devices and learn to work with metal and circuits and schematics.

A world I already encountered in my endeavors with circuit bending was that of effect pedals, or so-called stomp boxes. Not only limited to guitar players, I have encountered effect pedals in many situations, including studio recordings, experimental performances and
almost every band I have seen on a stage.



fig 3.3 multiple pedalboards combined and interconnected.

3.3.1 history

The world of effect pedals started when Jimi Hendrix and other guitarists in the sixties started using foot switchable circuits on stage to further shape the sound or boost the amplitude of their amplifiers. Roger Mayer had already constructed so-called fuzz boxes for Jimmy Page and Jeff Beck when he met Jimi Hendrix. The Octavia effect (an overdrive pedal, which adds a sub-octave to the signal grabbed Jimi Hendrix attention and the work the two have done in the years that followed shaped the way we look at and use guitar effects. (Hodgson 2011)
From string gauges to the tuning of the guitars to the effects and combination of guitars and amps, Mayer was as much responsible for the sound as Jimi Hendrix himself. A great example of the benefit a musician can have from an engineer.



fig 3.4 Jimi Hendrix playing his wah pedal.

3.3.2 fuzz

Early effects were based on dynamics and used to further boost amplifiers on stage. This led to distortions and overdrive sounds and this led to the evolution within effect pedals from simple boosters to a rich and exotic catalogue of distortion, fuzz and overdrive circuits. Cloned, modified and circuit bent over the years and recently these circuits and their evolutions and clones have been extremely well documented and explored in internet communities. (freestompboxes.com)



fig 3.5 A collection of fuzztone pedals. Picture by Germanium 1999. http://www.flickr.com/photos/germanium/866689808/

"Used to record the single '(I can't get no) satisfaction' by the Rolling Stones, the FZ-1
was the first distortion effect (Fuzztone) on a hit record."

- Fuzz Guide, The science, history, artists, methods and devices of the greatest effect in history of music: fuzz. by kubton.com

3.3.3 modulation

Apart from capturing amplifier sounds and artifacts from overdriving amplifiers in small stomp boxes, the guitarists also wanted to use effects on stage that were previously only available in recording sessions. R.G. Keen classifies effect pedals into 5 main categories (Keen 2000):

-Amplitude base
-Waveform distortion
-Filter/Frequency response
-Time delay
-Miscellaneous effects such as harmonic generation and the talk box.

Every effect can be placed in one of the first four categories and every effect has it's roots in either an effect resulting from a playing technique, for example the use of the tremolo bar on a guitar for vibrato, or an phenomenon resulting from equipment, unstable tape recorders speeds or the overdriving of an amplifier. Since tape dominated the recording industry for over three decades, we have a lot of modulation effects and delays based on tape recorders.
Today many great effect pedals are (digital) clones of those earlier devices. For example the recent Boss re-20 pedal is a direct imitation of the roland re-201 space echo.





fig 3.6 + fig 3.7 The original Roland space echo tape unit and the reissue digital effect pedal by boss.

Robert Fripp was an early pioneer in the field of tape effects, he used two Revox tape recorders to create long ambient drones and soundscapes with his guitar from the early sixties onwards.



fig 3.8 Robert Fripp pioneering his Frippertronics by utilizing tape recorders as looping devices for guitar improvisation.

In the seventies with the arrival of solid state bucket brigade delay technology (a delay circuit using IC based circuitry without any moving parts, like it's tape predecessors) came chorus, phasers, flangers, vibrato and echo and delay units, still explored and combined into new effects today. Those early designs were analog and had a lo fidelity now sought after and labelled warmth. Quickly after the development of the analog bucket brigade delay came the first DSP (digital sound processing) effects, including digital delays and effects capable of carbon copies of a signal with a much higher quality, because of a lacking in added so called warmth, both analog and digital designs are still equally popular and produced today.

3.3.4 experimentation

In order to built something original I need to start building prototypes and get away from cloning and building existing circuits. New effects can be found by combining not only various existing designs , but also using technologies outside the music industry. I have had great success using a Wiimote hidden inside a ball during a performance, triggering sound effects and samples during the piece. It required practical and technical solutions that fitted the needs of the piece and the performers and by combining two very different things I came to a new use of the wiimote and a way to make it invisible on stage. Here's a simple graphical representation I made to present the original idea to the theater group:



----->



During my time as an intern with Jos Zwaanenburg, I explored the possibilities of electronic effects by adding a laptop to each of the eight acoustic instruments in an ensemble and by contact mic and a max patch, players had realtime effects reacting to their performances dynamics and pitch. Under supervision of Jos Zwaanenburg I learned new strategies to manipulating an acoustic instrument, by better analyzing the instrument and the performance, extracting useful data and mapping them to interesting effect. It was an intense time, where I spent long hours programming and testing out ideas and patches with the eight musicians. It was very rewarding to watch the piece unfold, we played it for a small audience at the conservatory of Amsterdam late 2009.

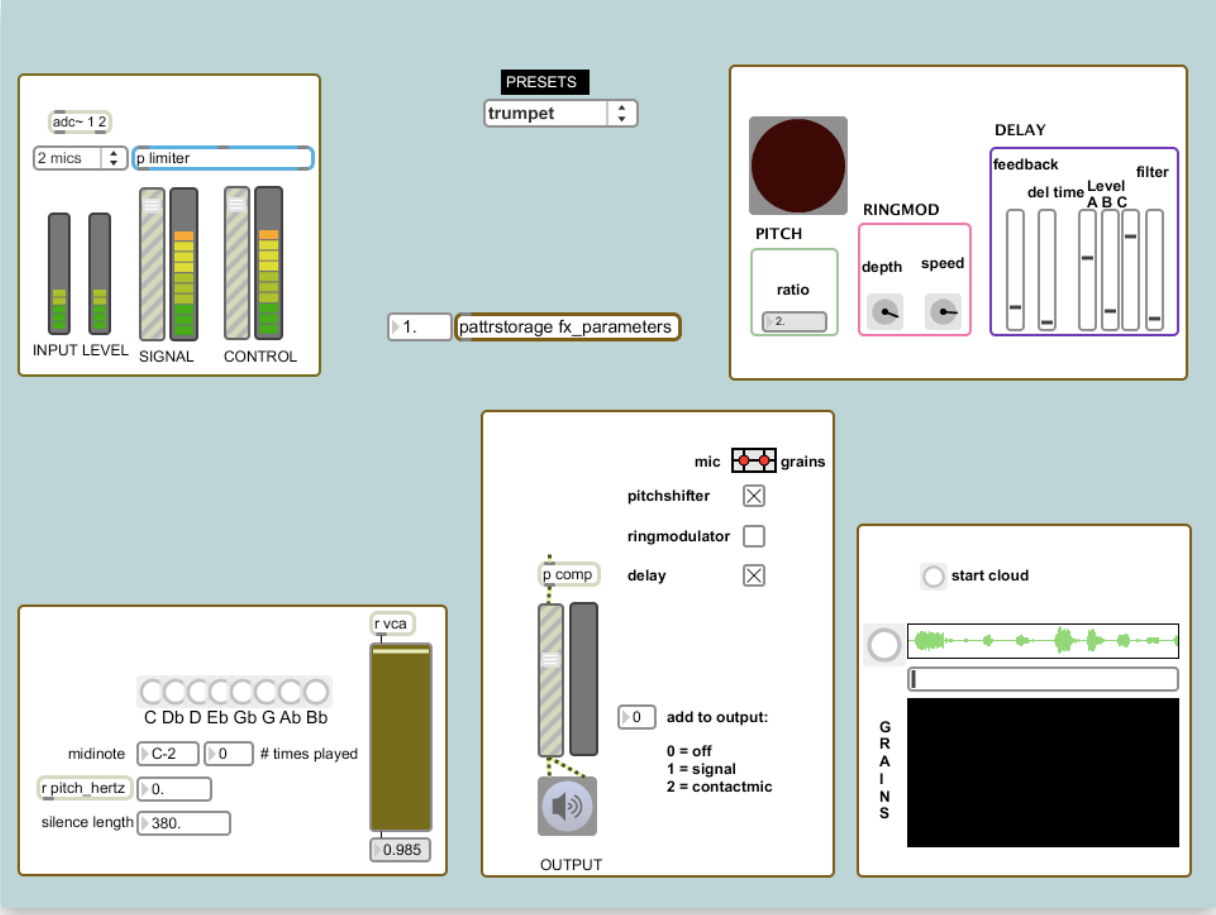


fig 3.9 The max patch I wrote for each of the eight performers of the piece "Octet '61" at the Conservatory in Amsterdam 2009.

3.4 Sound Generators

In addition to effects and ways to manipulate sound, it is easy to build your own sound generators. Oscillator circuits, tape devices and full featured synthesizers come in all shapes and forms. The eurorack family of synthesizers allows users to set up a modular system by adding small building blocks in the form of single rack space panels containing an oscillator, LFO, pattern generator, filter, or any other sound shaping circuit. A variety of big and small brands are available in the eurorack, as well as numerous smaller companies, a lot of pedal builders branch out into the modular synthesizer world (http://www.umop.com/tm7.htm), and Moog has great success with their Moogerfooger range of effect pedals. Like those mentioned Moogerfoogers a lot of pedals provide CV input so you can connect them to a modular system.
(http://www.moogmusic.com/products/Moogerfoogers)
I have hacked simple sound devices into more usable sound generators, for example the buddha blender, it contains small chant boxes I mail ordered, each one has a button to switch through 5 loops, a volume pot and a small speaker. I removed the speaker, installed a 1/4" output jack and added a pitch pot to the circuit, I boxed several into a big wooden enclosure and used it in a few performances. I am working on a second version of the buddha blender, where I'll have two circuits in a small enclosure with a single output and a pot to blend between the two voices.



fig 3.10 The buddhablender (to the left) with a simple mixer and a kaosspad as a performance setup.

I would like to improve my knowledge on actual sound generating chips and circuits and build sound circuits completely from the ground up, but I have enough to work with at the moment to explore and learn from. It is a long way up the learning curve, but over the past six months I have experienced serious progress and a confidence that will take me further with my work.
I'd like to continue working with a circuit bending mentality to experiment more and get a better idea of what will work in my future designs. You learn an incredible amount when you have to built a circuit into an unconventional enclosure as you do with a lot of circuit bending, when you have to add knobs and switches to a furry caterpillar shaped toy.







fig 3.11 + 3.12 + 3.13 I built a MFOS 'wsg' synthesizer kit inside an old Sega Master System II game console case. http://musicfromouterspace.com

3.5 software solutions

Working with software and programming tools, sound generators and effects in max/msp and the Nord modular advanced my sound design skills in areas that overlap with the design and building of hardware tools. I benefit from this experience in two interesting ways.

3.5.1 software prototypes

I can prototype and test my feature hardware designs on my computer, estimate the effects of modifications and achieve new ideas. The computer is a clean, fast and very straightforward way of experimenting compared to a breadboard. The logic approach of a max patch has similarities to a circuit, but is less sensitive to outside factors, it proves to me a very stable and rewarding place to explore sound design. The Nord G2 modular is another fast and good way to explore sound. It has most of the building blocks required to rebuilt a lot of circuits and ideas and is much easier to control, modify and save.

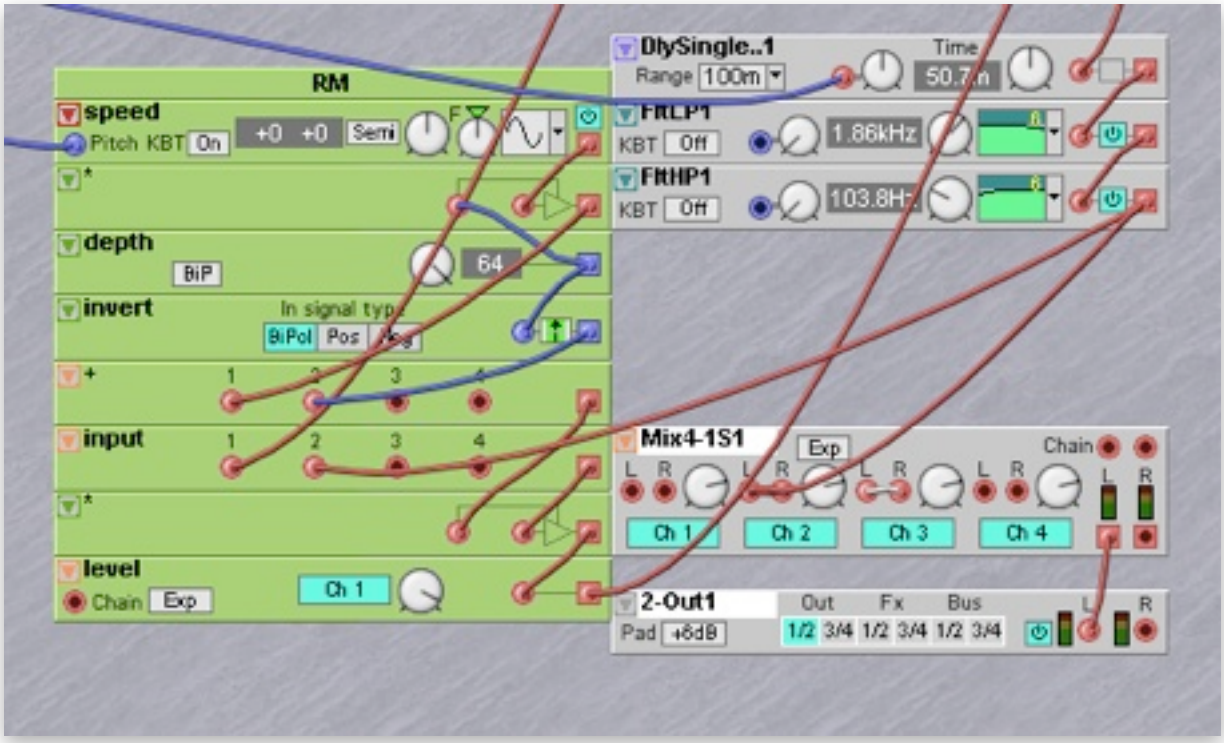


fig 3.14 Experimenting with ring modulation with the Nord G2 engine.

3.5.2 software controllers

Besides the keyboard we can use percussion and wind controllers, guitar simulations, the voice and sensors. Because of small innovations and in a lot of cases diy (monome) the midi keyboard has evolved into matrix controllers(launchpad, akai apc), turntable(ms pinky, traktor), motion tracking and video interaction (jitter), joysticks, wiimotes and many other 'hacked' controllers. (http://web.media.mit.edu/~joep/SpectrumWeb/SpectrumX.html)

And what a user is capable of doing with such tools is up to the software designer and the mapping between a device and the software. This mapping is an ongoing learning experience. My 'funambulism' patch is a granular delay system for processing audio over 4 speakers.

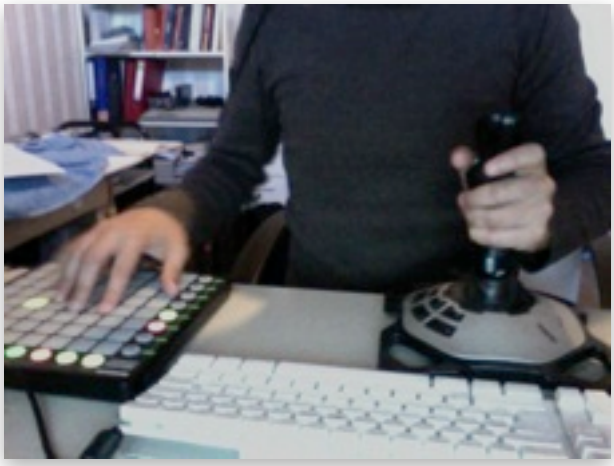


fig 3.15 I use max to map the joystick movements to the distribution of the grains over the four speakers and I use max/msp to map the novation launchpad as a color coded matrix to what delays are active.

I wrote the patches and tested it during a residency at STEIM with the Live Cinema ensemble. And kept improving it after every performance and last year used it in a new ensemble. After a few periods of improving and practicing I now have a very powerful, unique performance tool, which is stable and easy to play with.

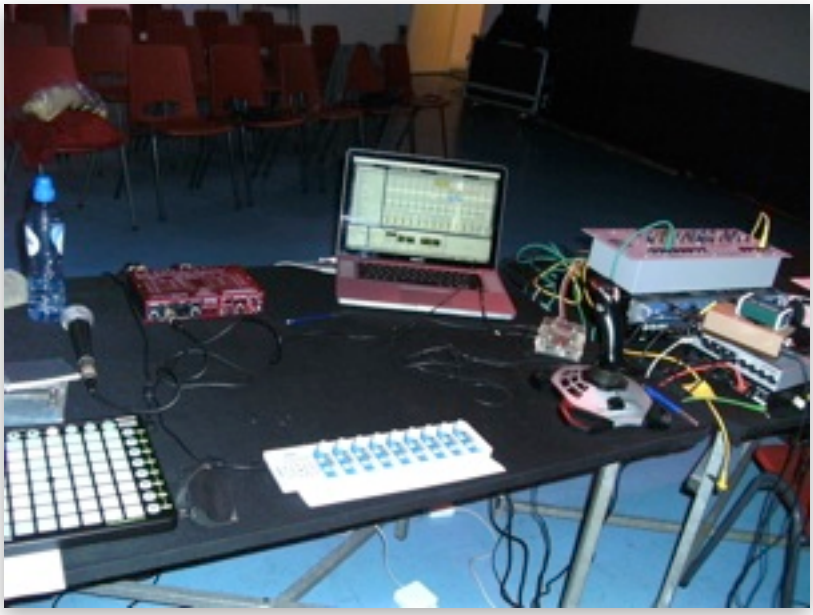


fig 3.16 My performance setup for the Orpheus2010 Live Cinema performance.

3.5.3 hybrids

Another aspect of software programming that attracts me is connecting both worlds, the world of hardware, sensors, gestures and controllers and the world inside the box.
Effect pedals with Arduino, software controlled circuit bending, a lot of experimenting has begun in the overlap between the various disciplines, but there is a lot more to invent and build.
Sparkfun electronics is a company that has a lot of tutorials and resources and you can buy Arduino and related materials and components to build all sorts of cross-media installations.

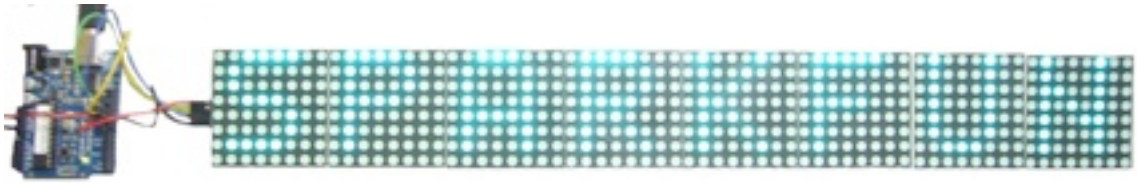


fig 3.17 We want to use electronics to make art projects, gadgets, and robots. We live, eat, and breathe this stuff! The SparkFun crew works in various departments such as engineering, marketing, production, shipping, and keg replenishment, all united in one common goal - Sharing Ingenuity. (from their website http://sparkfun.com)

The Arduino platform is an example of a cheap and easy way to connect the software and hardware worlds together and from there any modern laptop is capable of connecting all kinds of controllers, sensors and capture sound and images. Finding strange combinations and creating simple and useable interfaces for use in a performance or studio environment is an ongoing part of my work.

Besides creating new controllers and experimenting with micro-controllers, we can already create new tools by using existing technology in a new way. A laptop equipped with a little bit of software is capable of analyzing live video and audio data and mapping joysticks, or other control surfaces to musical gestures.

4. Applied tools and techniques

4.1 sound design

A large part of the work I do is related to sound design. The purpose of these designs is either to create new sounds or manipulate existing sounds and instruments to do so. Sound design is a wide term and this paper relates to the audio design and sound art side of the term, not the traditional ‘ composing sounds for film ‘ . I believe a good knowledge of sounds and it’s behavior is a large advantage in my work. To be able to judge if a sound is useful or worth further developing and also to understand what you are trying to reach with a design and when to consider it done.

4.2 signal theory

As in synthesis, a good knowledge of signal theory is required in the design of both circuits and audio software. The oscilloscope proves not only a problem solver, but also a new approach and more exact way to literally look at sound. A lot of effects are harsh and modify a signal in ways that small changes in a design are undistinctable by ear. Looking at a signal on a scope or in the form of data or a simple measurement with multimeter will sometimes tell you something, your ears can’t. Although it is good practice to measure and be exact in your work and always strive for perfection, a lot of great designs and sounds are achieved by working by ear and as with everything related to sound design, it is not an exact science, but an art form.

“Rule #17: If it sounds good and doesn’t smoke, don’t worry if you don’t understand it.” Hardware Hacking - Nicolas Collins



fig 4.1 My soldering, testing and construction workspace.

4.3 electronic engineering

All art requires crafts and crafts are skills that are perfected by both practical experience and learning the rules and procedures. Electronic engineering is a large field and there are many starting points in studying it, I pick up knowledge as I go along each project and try to pick up something new every time.

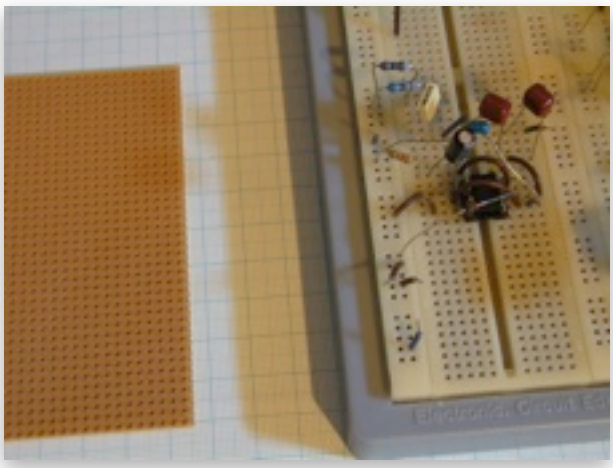


fig 4.2 From breadboard prototype (right) to perfboard (left)

I also read up on articles related to my work, but in another context, hobby websites for electronic engineering in non musical fields, model trains for example, are less biased towards sound and can often give you fresh ideas and techniques overlooked when everyone is focussed on the same methods.

4.4 soldering

Good soldering skills are a necessity and is developed by trial and error. The better the solder joints, the less time you'll spend debugging your circuits and the better your succesrate, the more confident you get and so forth.

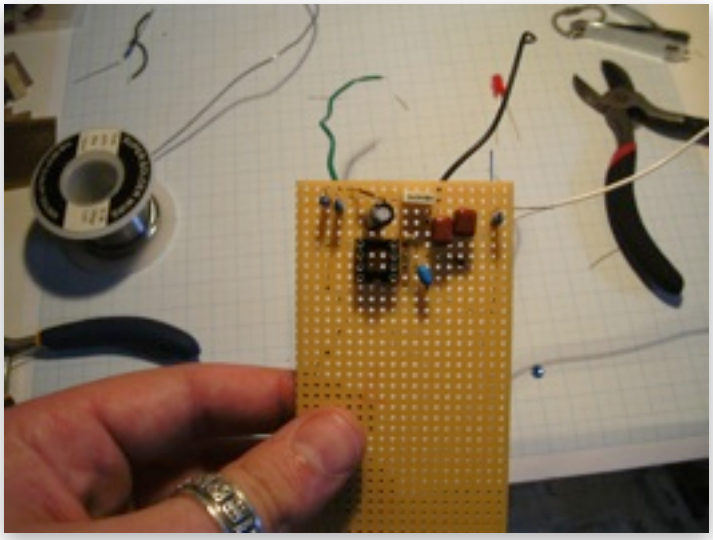


fig 4.3 Finished perfboard circuit.

4.5 programming

Programming is in a large way identical to creating circuits, we are in both situations limited to certain mathematical logic and laws of physics to make something work and behave in a desired fashion. And both have an almost identical learning curve as I illustrated on page 16 .

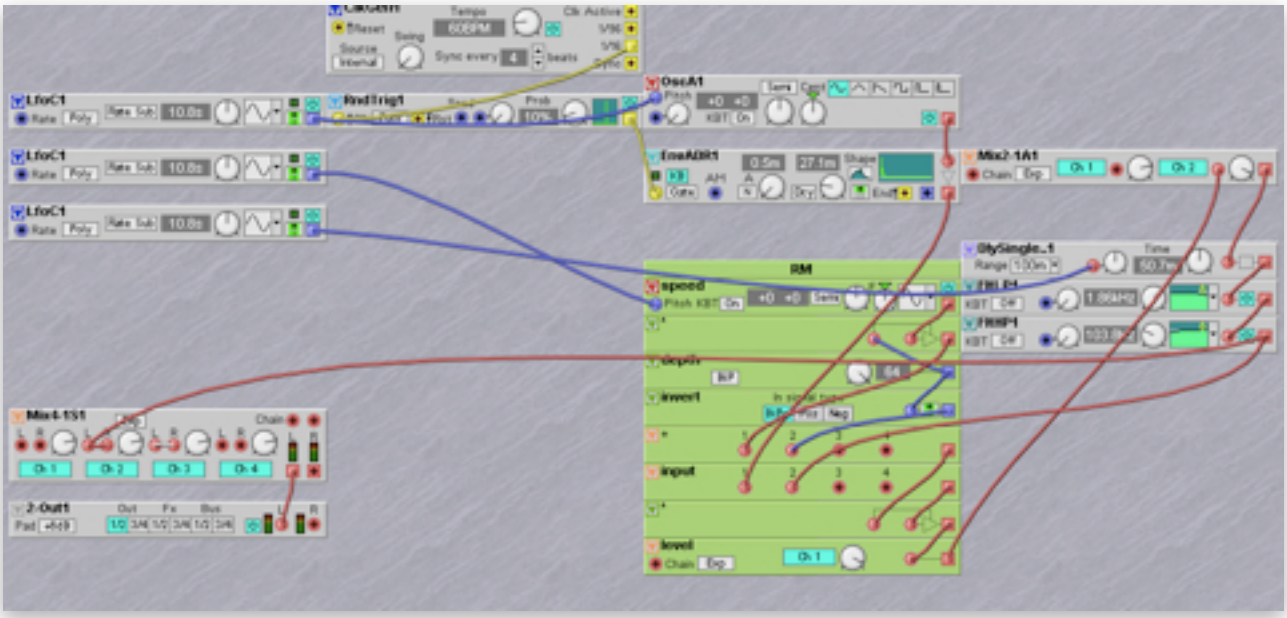


fig 4.4 The Nord G2 is a powerful modular synthesizer and rich featured studio tool, making it a perfect environment to test and prototype new sounds and ideas.

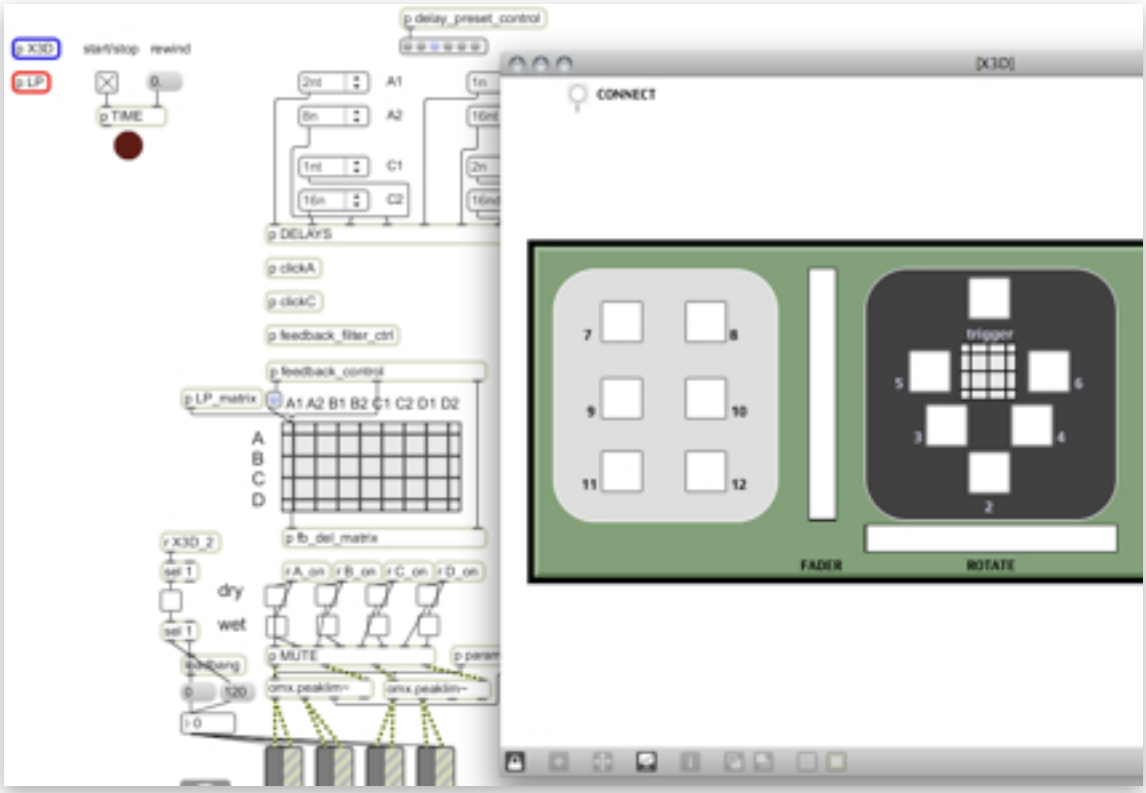


fig 4.5 Parts of my ‘Funambulism’ Max software described on page 31.

4.6 interface design

In the age of the interface, it is of an upmost importance in every design, software or hardware, to build and create a useful and inviting interface, successful commercial products are often praised for their interface.



fig 4.6 The Korg Kaosspad 3 is an XY touchpad effects processor, sampler and midi controller. http://korg.com

Korg have their Kaoss Pads, which are a way of taking sounds into the domain of muscular control. If you have a few Kaoss Pads in line, like I do, you can really start playing with sound itself, with the physical character of the sound. The pads are very intuitive, anyone can learn to use them in a second. It's immediately obvious what you do, and it immediately takes you into a completely different place, because when working with computers you normally don't use your muscles in that way.
- Brian Eno quoted in Sound on Sound October 2005

Besides making a device easier to work with, an interface dictates a users performance and a better interface usually leads to better use. Also it can lead to design problems, which provide a basic idea and often healthy limitations for the artwork. In a well designed product, both art and interface design are thus complementing each other.

4.7 artwork

Artwork is closely related to interface design and the two influence each other greatly. Art is a part of design that is to me as important and challenging as the circuitry of a design. Even a max patch is more inviting if it has a background tint, some color, maybe small pictures. In stomp boxes there is not a lot of space, nor variety in the way a design is laid out. One or two foot switches, one to several potentiometers and sometimes a few switches. Almost every diy stomp box fits this description and sizes do not vary that much, from a few industry standard sizes.
Still there are designs out there every day that surprise me and with some the art is almost as desirable as the purpose of the effect itself.

I use hands-on processes, mixed media, from screen printing, to self-developed stamping, painting, and graphic processes. The result of my DIY approach to building instrument effects makes for a product with a more unique, less "factory" look...an appearance of being hand-built or crafted, which (hopefully) adds to the appeal and pride in ownership. Many are one-of-a-kind pedals, with brush-strokes.

(Tom Dalton, FuzzHugger effects, the entire interview can be found in Appendix B)

Also the artwork can give your designs a personal character or help sell them, everyone wants their instruments to look good!



fig 4.7 A pedal painted by artist Pat Corrigan for fuzzhugger effects. http://fuzzhugger.com

5 Evaluation

5.1 results

I want to specifically examine a selection of the products I made during the past 6 months of researching this subject. Here are some picture build logs of some of the things I built, followed by my personal review and some by musicians I worked with and who have used these devices.

5.1.1 circuit bending



fig 5.1 Blue toy wheel added an on/off switch, led and 4 body-contact points for controlling the clock speed and glitches.

I circuit bended this steering wheel toy, by adding 4 contact points to the circuit and adding an on/off switch with LED. The toy was old and the circuit and components fragile and it stopped working after a few days of use. Still it is aesthetically a very pleasing result and for a switch, LED and 4 metal pins, no loss at all. It is a fine example of the often short lives a circuit bended toy can have, but how simple, fun and pretty the results can be.



fig 5.2 Vtech Teddy The Bear toy painted and I added a 'loop' and 'glitch' switch.

A V-tech talking teddy, I saw getting 'bent' during the first circuit bending workshop I did in 2008. I found a similar teddy and did an homage. There's only a loop and glitch switch, otherwise it still behaves normally.



fig 5.3 Bert and Ernie toy-phone, light sensitive right eye glitches and alters the speed of the sounds.

I always wanted to experiment with photosensitive cels, or so called 'light dependent resistors' LDR. Here I glued one into the phone's right eyes and placed in place of the resistor controlling the clock speed of the circuit. It's a lot of fun and gives me a lot of ideas. One being vectrols, which I've used in the modification of an Electro-Harmonix Small Clone pedal, described later.



fig 5.4 The Casio SK1 sampling keyboard, bended according to Reed Ghazala's 'Aleatron' layout. (Ghazala 2005)

The famous Casio SK1 sampler, I did everything I could to this one. It is a very early project of mine and although it has a very bad solder job and almost falls apart, it got me started and I used it enormously in my work and performances. I have more SK1's which I use as regular samplers and I still want to work on one with an external controller for it's numerous switches. Even bridging it to max would be a possible and that proves why the sk1 is a classic machine for circuit bending, there is so much to bend and add to the already large sonic palette, also due to the almost ancient, but characteristic sampling capabilities.



fig 5.5 Realistic Rap-Master, painted and added feedback loop, glitch and noise controls. Also combined two different manufactured rap masters and a boss pedal to get the knobs and switches in a Jamaican 'dub' color scheme.

Here is another casio from the eighties, the rap-man, or in this version the realistic rap-master. It is a not very musical keyboard by casio, with a lot of generic early rap and disco loops, the one thing that stands out is a microphone input and a 5 way switch to pitch shift the incoming signal. I created an internal feedback loop through the pitch shifter, creating dub style effects heard on early king tubby production. I took apart two rap-man keyboards to collect enough parts for the reggae layout and color schemes. I am very proud of the way this looks.

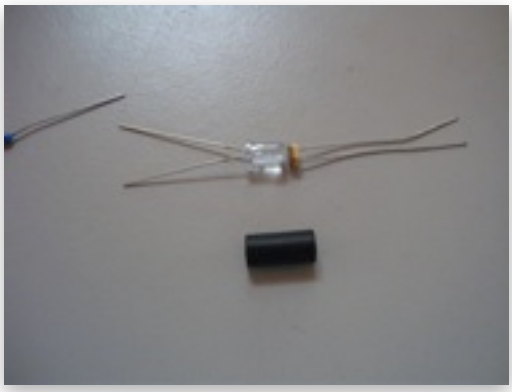
5.1.2 modification

The small clone is a chorus pedal made by Electro-Harmonix, it is a simple unit, with a few drawbacks. There is a control for the rate and a switch for the depth. Now the rate range is just fine, but the switch goes from very gentle to very deep and thus a seasickness effect. I knew there were a lot of possible modifications and really wanted to be able to get more out of this pedal.



fig 5.6 The Electro-Harmocix Small Clone chorus, with tremolo and depth pots.

I found several reports of successful modifications and decided on what I wanted, I wanted the depth switch replaced by a pot, giving me a large range between subtle and seasickness. I also found a very simple and logical tremolo mod, by connecting a so called vectrol (LED into an LDR) to the LFO and using the resistance on the output of the pedal, by adding a pot to the resistance, you can vary how much the vectrol influences the output, thus how deep the tremolo goes. The tremolo is in synch with the chorus, because they share a similar LFO.



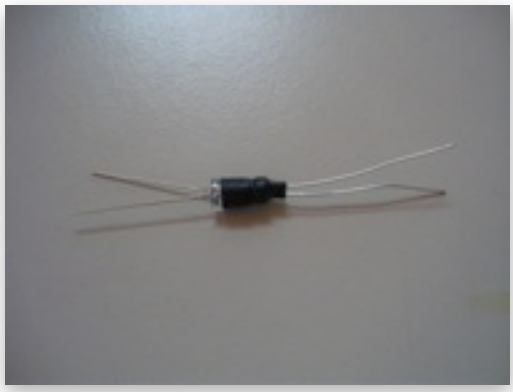


fig 5.7 + 5.8 A DIY vectrol.

The small clone is a welcome addition to my pedalboard and it was an easy and fun build without any difficulties, the vectrol part gave me a lot of new ideas to work with.

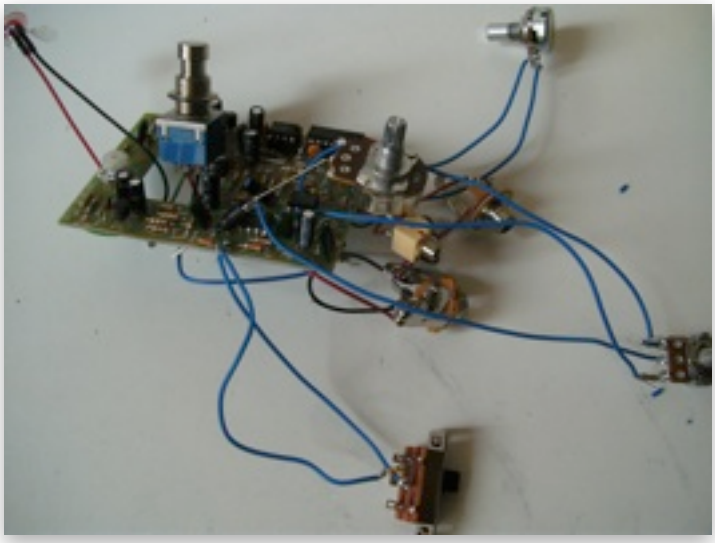


fig 5.9 The modified circuitry of the small clone.

5.1.3 Effect Pedals



fig 5.10 Tim Escobedo's Too Many Knobs fuzz, is an IC based fuzz and distortion circuit and the graphics were done by Michael Polane.

I enjoyed building the pedal and having someone else do the artwork. The results are far beyond my capabilities as a graphic artist. And I am happy to have found some enthusiastic artists to work with in the future.



fig 5.11 The hysteresis pedal, notice how I made a drilling mistake and switched around the stomp switch and LED. It's not a big mistake and it gives the pedal a nice 'face', so I left it this way.

This is the first effect pedal I built, I took two simple schematics, one of a 555 timer oscillator and a tone control and put them both on breadboard. I tried different parts, exchanged parts and just went with the flow, until it sounded just right to me.

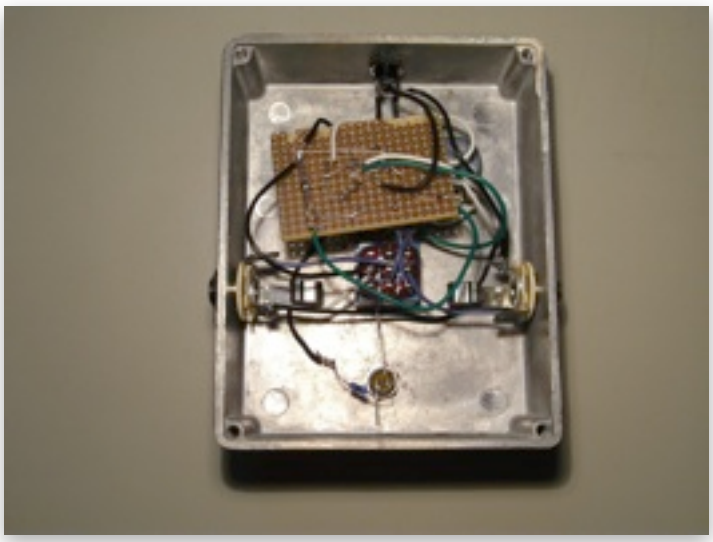


fig 5.12 Inside the pedal

I used a small piece of perfboard and soldered my results to it. It works and although it is a very simple circuit and nothing original, it showed me I didn't have to rely on other people's layouts and circuit-boards to build my things, but that it did require a lot more preparation and knowledge. Compared to the echobase (described on the next page), both pedals are equal in difficulty to produce, a good layout and clear interface design is really half the work.



fig 5.11 The echobase is an analog voiced delay circuit with modulation and a digital switching circuit giving you a lot of useful functions and options for further modification. http://musicpcb.com/pcbs/echo-base-delay/

The echobase is a very good analog delay with modulation. There is a lot of features and modification information available and I am building two more with different modifications to experiment with different versions of the echobase. The circuit is designed by Ian of musicpcb.com and further developed and modified to it's current form by members of the diystompboxes forum. Today it is available as a pcb and all the information you need to customize it. Here is the original thread on the echobase:

http://www.diystompboxes.com/smfforum/index.php?topic=60662.0

This shows the power of a good forum in the 21st century, the ability to share your initial idea and revise and perfect it with the help of hundreds of peers. Leading to, in this case a delay pedal, that can be compared to a lot of commercially produced delays. with the same set of features.

An advantage of working with a pcb is that I had the most difficult part of the pedal already done for me, the design of the actual circuit. Constructing the case, collecting and soldering the parts and doing the artwork is where I had to be cost effective, original and creative. The result is great and I am very satisfied with the way it looks and functions. If I didn't build it, I would've bought it.

Recently I got my first request for a pedal, the instructions for what it should do were clear and I got some hints for the artwork. I used stencil techniques and a lot of layers of paint to achieve this effects, it turned out beautiful, the pedal looks worn and damaged in a good way and technically it does exactly what was requested. I am happy I am able build something like this for someone.



fig 5.13 A customized boost pedal, built on request.

Looking back over the past six months I learned that planning and endurance are more important to a good product than money or skills. You can do it yourself and you can learn techniques by reading up on them, talking to others and keeping an open mind to all sorts of arts and crafts, maybe not directly related to your own work. I am amazed how good my current paint-jobs look, compared to a year ago. Also I feel more at ease with trying new things.



fig 5.14 A second echobase pedal I am building.

I am less scared to fail, very positive about my work and the work of those that inspire me and it moves me forward.

5.2 external review

Over the past 6 months i have used husc effects-pedals as well as circuit-bent casios in the studio. Overall it can be said that the products are based on popular and some more obscure effects with the addition of practical features and original artwork. With regard of the artwork it can be said that each pedal looks different. Because husc utilizes different techniques, in addition to working with various artists, the pedals all have a unique look, which is a plus.

The first pedal i tried was the hysteresis pedal. This is a kind of noisy tremolo, which can speed up to be a very useful ring modulator. The noise levels on lower speeds makes it almost unusable as a tremolo, but this is inherit to the product design. All in all this was my least favorite pedal.

The echo-base is a very musical analog-sounding delay with some interesting features. Firstly, it has modulation, and with independent speed and depth controls it gives the possibility of a very subtle flutter (akin to tape-echo's) or a warbly seasick kind of vibe. The repeats of the delay itself are very musical and nicely blend in with the signal. Two features stand out: there is a trail on/off switch which lets the delays continue on the last note played before hitting the bypass switch. I consider this feature a must for live use. Secondly, there is a foot switch which lets you feedback the delay. This gives you the ability to control a normally very uncontrollable sound.

The TMK fuzz is one of the wildest fuzzes i've tried, period. Next to regular volume and gain controls the TMK offers crossover, bias and some other knobs i can't remember. This means that this fuzz is not very user friendly, but versatile. Especially the ability of making crossover distortion makes this a unique circuit. The art on the pedal, which featured a part of a comic book, was nothing less than awesome.

I am not very knowledgeable on casios, but the circuit-bent ones I have tried where exquisite noisemakers. In combination with some fx pedals they were also able to give lead as well as bass synth sounds. The theme of unique looking and sounding products is continued in the line of casios.

To summarize, it can be said that these are musical products which offer some unusual, but very musical features. Every single effect i have tried has a very distinctive sound of its own. Some may dislike this, but i don't, I love products with character.

- Samir Bouregdha

5.3 tools

I upgraded my drilling technique by buying and installing a drill press into my workspace, combined with a stepped drill bit, now I can drill more precise, faster and safer. I use a hand drill for plastic enclosures and often I find myself using simple tools like a nail clipper or file for a lot circuit bending.
I use a Dremel multi-tool and it is perfect for a lot of things, finding the right tool for the right situation is part of being safe and delivering good work. Power tools and even small power tools like a Dremel can hurt you very bad if you misuse them. Besides a few scratches and first degree burns, I am lucky and learned my lessons not too painful.



fig 5.15 A small desktop drill press, a perfect size for effect pedals and small synthesizer. panels

I recently bought an oscilloscope, I used my ears, a multimeter and simple audio-tester before. But an oscilloscope combined with my multimeter gives me a lot more insight in what circuits are doing to my signal and it will help me in the future with rating and testing my own circuits.

I am already experiencing the benefits of using those measurements in troubleshooting, when a circuit is not working properly, following the signal along the circuit board with a scope can show me where something goes wrong. And with working circuits it can tell me graphically what is happening to my signal. Combine that with math and a good way of documenting my findings and I can use these tools to create better, more accurate circuits in the future.

5.4 techniques

Painting is one of the techniques I had to learn and improve, I tried all sorts of methods and paint and learned how to create artwork and deliver paint jobs on pedals that are both creative and durable.

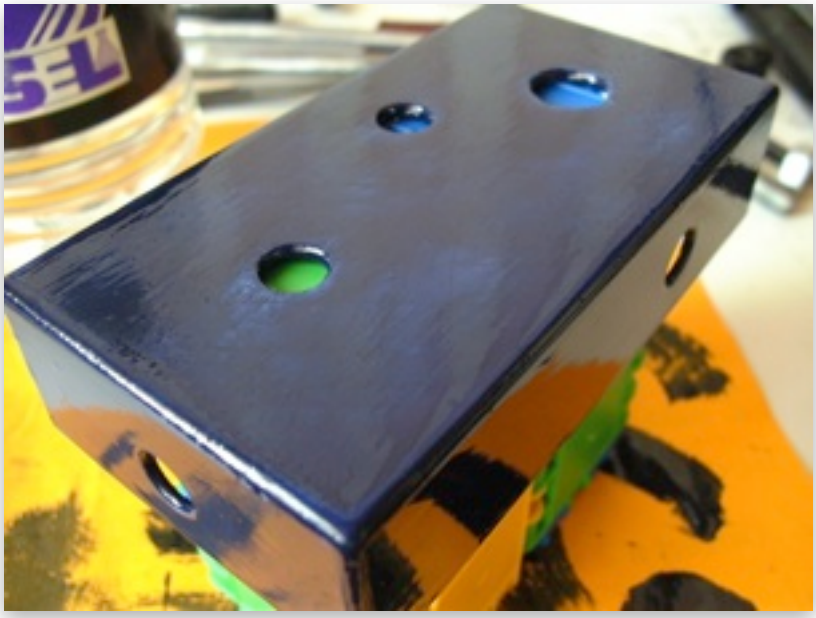


fig 5.16 I experimented with a very thick layer of blue boat lacquer for this pedal.



fig 5.17 For my second echobase I tried a lot of techniques and types of paint. Sanding of and overheating layers of paint in between transparent layers of lacquer. I carved the Echobase name in with a dremel and used any paint I could find, nail polish, lacquer, markers.

My soldering has become a lot quicker and I finish my projects with a lot more ease, I also notice less so called 'bad solder joints' and am becoming very good at troubleshooting my own work. So far, out of the 12 builds I did recently, one circuit bent toy died and two pedals are not working. The rest functions properly and is to my and everyone else who used it, standards. I need to continue to improve this skill and learn to work with more complex layouts on perfboard, a skill that is very different from soldering parts to a pcb.

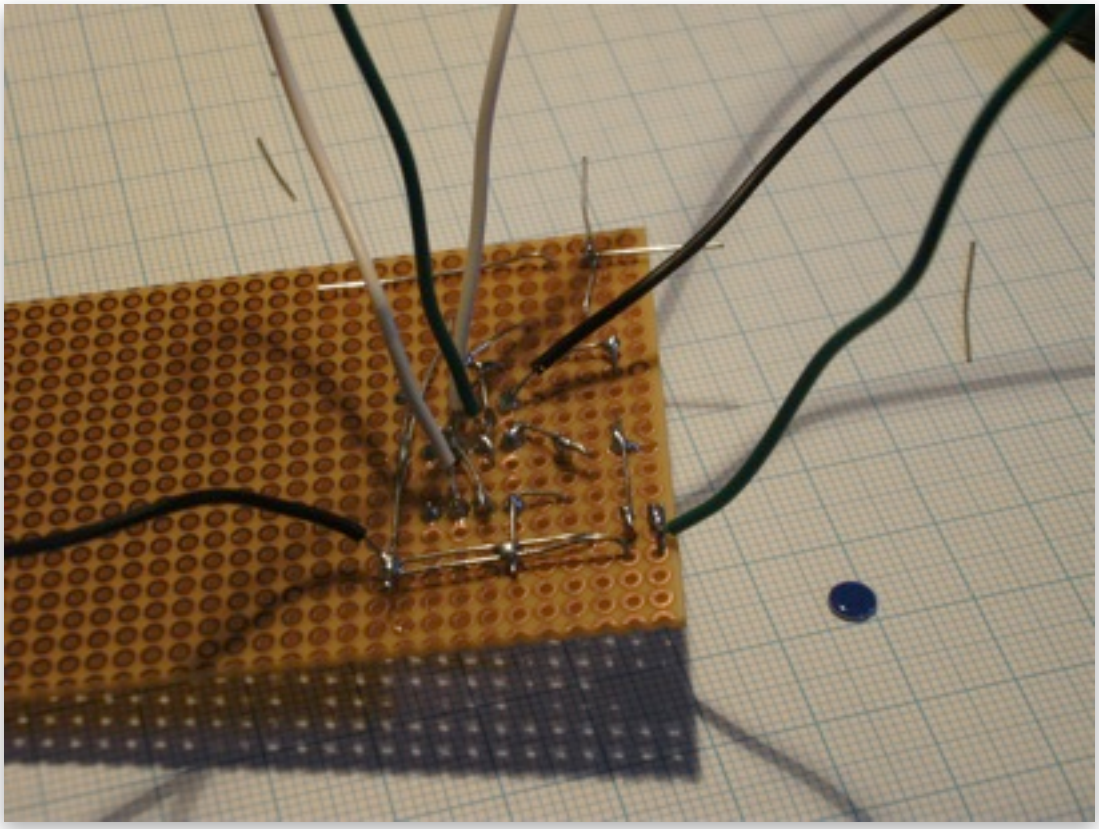


fig 5.18 Experimenting with perfboard soldering for my hysteresis pedal.

5.5 failure and improvements

Every problem solved is a big lesson learned in electronics and I came across quit a few. I have to absorb more general knowledge on basic electronic design and become more efficient at combining schematics and learning basic routines in circuits, such as buffering a signal and preventing clicks and pops.
I also want to start rebuilding circuits on the computer (max or g2) to learn more about the circuit's workings and further let the programming and electronic design grow closer, to help me with designing new and more competitive circuits in the future. Besides noisemakers, small synth kits and effects I need to start building sound generators, such as oscillators and expand my knowledge of hardware design beyond pedals and modification.
I have the tools and basic knowledge to start doing more complex work, but I learned that taking small steps, but learning a lot from them is a more efficient road to take than diving in the deep end with both feet.

6 Conclusions and future work

"Music in the twentieth century is, to a large degree, a technologically dependent, leisure commodity whose existence is guaranteed by the organized activities of a number of large corporate enterprises and media outlets." Paul Théberge - Any sound you can imagine (Théberge 1997)

The twenty-first century is a very different one, with the internet community overexposing products and technology. We have more knowledge and resources available to us and have the ability to create competitive products that even exceed the quality of products that used to be superior in the past.

The ongoing fragmentation and sharing of data exposes us to an enormous amount of material to work with. Choosing resources and filtering information will become more and more important as opposed to the past, where we had limited resources available to us and we relied more on local business and crafts.

It is going to be hard to be both original and make a living out of any form of sound design. The world is speeding up and so is your consumer market, they want things faster, easier and for less money.
It is easy to strife for a design that is so much more advanced and complex then your average user can comprehend, and it won't sell nor compete with larger companies who still have more money and resources available to them and access to the same information and user information as an independent operating designer.

Solutions to a more reliable income would be teaming up with other designers to help achieve exposure and increase each others market. Branching out into different fields and using technology and designs from one field in the other. Like guitar pedals for acoustic instruments, software to manipulate analog equipment, etcetera.

Spending time on specialist fora can give you a notion that every idea has already been designed and everything is built and done, but there are many musicians and artists out there who will have interest, but not the time nor experience to further explore the sound of their instruments.

There is a lot of work to do for those musicians and I prefer working on sound while not having to also worry about the notes being played. Playing with other musicians while taking on the role of live sound designer can lead to new improvisation and composition strategies and the musician can play along or against the manipulation.

I am setting goals and having some requests, hope to generate more interest in my work through others using it. By being a valuable member on fora and sharing my work consistently and in detail I will benefit and so will the communities I am part of. There is a lot to built and I have to be careful not to get lost in all those options. Limiting myself to a few projects each month and spending some of my time documenting and researching these projects should be sufficient to get my work to a next level within a year, when I want to have my own simple circuits working and patches written that can interact in new and challenging ways with musicians.

By using my tools and through my music exposing them to an audience I both gain insights in the quality of my work, but should also be able to benefit from the work I do. Providing customized solutions and expansions to an artists' sound palette and allowing them to work beyond the confines of their instrument, software or conventional sound devices.

Cutting up the past and pasting it together in new ways is a simplified and today very romanticized view of the state we are in today. Fragmentation of all media and events and the blurring of lines between technological fields is for me something to start embracing instead of holding on to past principles and notions of how analog we all used to be. We can be both, analog and digital in our work and we are free to use whatever technology we see fit. Keeping a positive mental attitude and an open mind should be sufficient to maintain a certain discipline in my work and stay motivated to keep learning and progressing.

There are downsides to DIY and there are a lot of downsides to being part of an expanding digital culture. A balance must be found between building things out of curiosity, as a hobby and working as a professional, and find ways to benefit from both those motivations. The internet is the best available resource for information and it is a great place to share and present your work, but when the information super highway becomes a two way street, there are a lot of unwritten rules you should bear in mind, to be part of the internet and push it in a good direction. As a lament on a lot of new fora I noticed that common decency, and a general positive attitude gets you a long way on the internet.

You can get fast solutions to your problems and be inspired. Nevertheless the internet is a small part of your work and it's easy to let it influence you to much. Being aware of what goes on online and how it influences your work and the real world around you is crucial to a designer in the 21st century and I see myself spending a lot of time updating and uploading. It costs a great deal of time and in a way it can be better spent working on new things, yet it feels more as a necessity than it did 10 years ago and I have a much larger audience now, many of whom I only know through those uploads and updates.

Bibliography and suggested further reading:

Collins, N. , 2006. Handmade Electronic Music: the art of hardware hacking. New York: Routledge.

Daniels, D. and Schmidt, B. U. eds. , 2008. Artists as Inventors / Inventors as Artists. Ostfildern: Hatje Cantz Verlag.
Elliot, R. and Newton, F. and Hammer, M. , 2010. The state of manufacturing, [online]. Available at: http://sound.westhost.com/manufacture.htm [Accessed 6 May 2011]

Grout, D. and Palisca, C. V. , 2006. Geschiedenis van de westerse wereldmuziek. 7th ed. Translated from english by Brand, F. Vernooy, R. and Wijngaard van den, O.

Gleick, J. , 1999. Faster: the acceleration of just about everything. New York: Vintage Books.

Ghazala, Q. R. 2004. The folk Music of Chance Electronics: Circuit-bending the Modern Coconut. Leonardo Music Journal, Volume 14, p. 97-104, [online]. Available at:http://www.anti-theory.com/texts/lmj/ [Accessed 15 July 2011].

Ghazala, Q. R. , 2005. Circuit Bending, Building Your Own Alien Instruments. Indianapolis: Wiley Publishing, Inc.

Hart, D. 2001. The Napster Revolution. [online]. Available at: http://wrt-intertext.syr.edu/ix/hart.html [Accessed 20 June 2011].

Hippel von, E. , 1988. The sources of innovation. New York: Oxford University Press, Inc.

Hodgson, P. 2011. Interview with Roger Mayer: The Secrets of Jimi Hendrix's Guitar Setup. Guitar World, [online]. Available at: http://www.guitarworld.com/interview-roger-mayer-secrets-jimi-hendrixs-guitar-setup [Accessed 4 July 2011]

Jenkins, H. , 2006. Convergence Culture: Where Old and New media Collide. New York: New York University press.

Jung, W. G. ed. , 2002. Op Amp Applications. Norwood: Analog Devices inc.

Kruijff de, J. ?. Elektronische muziek en elektronische muziekinstrumenten [online]. Available at: http://www.musicalifeiten.nl/fonografie-muziek/e/elektronische-muziek.html [Accessed 22 July 2011]

Kurzweil, R. , 1999. The age of spiritual machines. New York: Penguin Group.

Lorenz, E. N. , 1993. The essence of chaos. Seattle: University of Washington Press.

Miller, P. D. , 2004. Rhythm Science. Cambridge: Mediawork/The MIT Press.

Miller, P. D. ed. , 2008. Sound unbound: sampling digital music and culture. Cambridge: The MIT Press.

Manion, M. , ? . From tape-loops to midi: Karlheinz Stockhausen's forty years of electronic music [online], Available at: http://www.stockhausen.org/tape_loops.html [accessed 2 July 2011]

Mims III, F. M. 1979. Forest Mims Engineer's Notebook. Eagle Rock: Technology Publishing

Nyman, M. , 1999. Experimental music, Cage and beyond. 2nd ed. Cambridge: Cambridge University Press.

Ross, N. , 1991. Strange Weather: culture, science and technology in the age of limits. London: Hayworth Publishing.

Sacks, C. The history of musical instruments

Théberge, P. , 1997. Any sound you can imagine: making music/consuming technology. Hanover and London: University Press of New England.

Toffler, A. 1980. Third wave. New York: Bantam Books.

Toop, D. 1995. Ocean of Sound: aether talk, ambient sound and imaginary worlds. London: Serpent's Tail.

Toop, D. 2004. Haunted Weather: music, silence and memory. London: Serpent's Tail.

Zwaanenburg, J. 2007. Live Electronics, Standardization and Tradition. Translated from Dutch. Dutch Journal of Music Theory. May 2006, volume 11, number 2.

Documentaries and movies:

Bent 2004. 2005. [DVD] Sajabel, D. Absurdity.Biz

Beautiful Losers. 2008. [DVD] Rose, A. and Leonard, J. Sidetrack Films.

Fuzz: The Sound That Revolutionized The World. 2007. [DVD] Taylor, C. Brinkfilm.

I Need That Record: the death (or possible survival) of the independent record store. 2009. [DVD] Toller, B.

It Might Get Loud. 2008. [DVD] Guggenheim, D. Sony Pictures.

Handmade Nation; The rise of diy, arts, crafts and design. 2009. [DVD] Levine, F. distributed by buyolympia.com

Metal machine music. 2009. [DVD] MVD Visual.

Me, You and Everyone we know. 2005. Miranda July.

Modulations. 1998. [VHS] Lee, L. Caipirinha Productions.

Moog. 2004. [DVD] Fjellestad, H. Plexifilm.

The pictures are made by myself, unless stated otherwise, pictures used in the interviews belong to the person interviewed or are taken from their websites.

Appendix A: Links

Here is a link of websites used and referred to in this paper as well as links used in my work and ongoing research. A much longer list could be made, yet this list will serve as a good starting point.

artists and companies:

http://anti-theory.com
http://www.aronnelson.com/aron2/
http://www.borndigital.nu/
http://casperelectronics.com
http://cylob.blogspot.com/
http://guitarfetish.com
http://www.gyraf.dk/
http://www.generalguitargadgets.com/
http://husc-sound.com
http://little-scale.blogspot.com/
http://wiki.muffwiggler.com/wiki/Rob_Hordijk_Designs
http://www.musicfromouterspace.com/mfosweb/home.action
http://www.musikgear.com/
http://www.newtone-online.nl/
http://paia.com/
http://peauproductions.blogspot.com/
http://stompboxes.co.uk
http://www.sparkfun.com/
http://www.tonepad.com/

(DIY) electronics:

http://www.beavisaudio.com/
http://cgs.synth.net/
http://etherra.blogspot.com/
http://gaussmarkov.net/wordpress/
http://www.geofex.com/
http://hackaday.com/
http://www.home-wrecker.com/
http://makezine.com/
http://www.musicsynthesizer.com/
http://www.obsolete.com/120_years/machines
http://www.smallbearelec.com/home.html
http://sound.westhost.com/beginners.htm (great beginner's guide to electronics)
http://www.seymourduncan.com/support/wiring-diagrams/
http://synth.net/
http://www.synthtopia.com/
http://weltenschule.de/TableHooters/instruments.html

fora:

http://diystompboxes.com
http://www.diyaudio.com/forums/
http://experimentalistsanonymous.com
http:/electro-music.com
http://freestompboxes.com
http://matrixsynth.blogspot.com/
http://midibox.org/forums/
http://www.newtone-online.nl/forum/ (in dutch)
http://nuigroup.com/go/
http://www.prodigy-pro.com/diy/

software, micro-controllers, and related links:

http://www.ableton.com/
http://www.arduino.cc/
http://www.audiosynth.com/
http://chuck.cs.princeton.edu/
http://www.clavia.se/nordmodular/modularzone/
http://cycling74.com
http://design-interact.blogspot.com/
http://disis.music.vt.edu/main/
http://itp.nyu.edu/physcomp/sensors/Reports/MMA7260Q
http://kc.koncon.nl/downloads/ACToolbox/
http://www.ladyada.net/
http://www.maxbotix.com/tutorials.htm
http://www.maxforlive.com/index.php
http://www.opasquet.fr/code
http://puredata.info/
http://roamingdrone.wordpress.com/
http://rhordijk.home.xs4all.nl/G2Pages/index.htm
http://www.smartelectronix.com/

Appendix B Interviews

While doing my research I emailed a number of musicians and artists with a set of questions related to my subject. I did this to get insights and different points of view to use in both my work and research for this text.

'DIY or buy: the future and importance of diy culture on music technology'

Please introduce yourself and your work.

1. First instant reaction to the topic title.

2. Do you feel that current audio and music technology curriculum should include diy related classes? If so...why? And if you think it should be included, how can it help the field?

3. Given the opportunity to design, build or create a musical product, what would be your procedure and how would it be different or similar to a commercial designed and produced product?

4. How would your knowledge or design help you to create products in a better way?

5. DIY or buy and why? (This applies to the consumer and production of musical products)

6. Do you think diy culture is still in it's infancy in music? Please comment.

7. How do you see the future for diy culture in music?

8. Any final words?

The interviews were done in March, April and May of 2011 through email. I have spoken directly and discussed the various subjects relating my research with Rob Hordijk , Maarten Halmans, Michael Polane and Teun de Reeper.

I thank them for their insights and opening my mind to new ways of looking at the subject. I have also a deep respect for the mutual enthusiasm and devotion I see in everyone I encountered and their work. The DIY world is a very dynamic and wide spread community, but everyone in it shares a similar passion to build things and share work and techniques. Besides the growing feeling of being overwhelmed by the amount of work and new media coming at you on the internet on a daily basis, I feel very positive about the future, with common sense and persistence one can benefit enormously from the accelerating information age.

"You hardly perceive the acceleration of arts and entertainment: the changing pace of media from cinema to television commercials, which reflect and condition a changing pace in our psyches. (Gleick 1999)

All the questions for the interviews were aimed at a cultural and philosophical research into DIY, my projects relate to practical subjects, but there is also an important cultural and philosophical side to 'diy' to expose and research. The following answers served as an inspiration, not only to my graduation project, but also to myself as sound designer.

My name is Thomas Dalton. I build guitar effects pedals for a living, am also a dealer for other effects manufacturers, and operate an online community promoting discussion of music, instruments and instrument effects, and DIY effects building and modification.

http://fuzzhugger.com



First instant reaction to the topic title.

I have a complex reaction to the question, "DIY or buy?" because I have done both...moreover, because of my long-running tendency toward DIY, I now *sell*, and others buy. Of course, I've continued to also buy in some capacity (for personal use, and for reselling purposes...one doesn't necessarily defeat the other). And also, at some point, my "business" is a sort of DIY, as I continue to "do it myself." The entire process for me has been a sort of DIY project (though I do make money from it, it is much more for my enjoyment). I haven't been formally trained in business or marketing. Also, I work/build/sell in a subculture where the lines are especially blurred between DIY and "commercial" products...thanks to message boards, one user might see another's DIY project, and ask that to make one for them. Many of us share/collaborate on information, processes, and resources; many of us make DIY pedals for our own needs, which also become products that are sold.

Do you feel that current audio and music technology curriculum should include diy related classes? If so...why? And if you think it should be included, how can it help the field?

I absolutely feel that current audio and music technology curriculum should include DIY related classes. DIY classes can increase students' abilities to repair, problem-solve, and also to innovate!

Given the opportunity to design, build or create a musical product, what would be your procedure and how would it be different or similar to a commercial designed and produced product?

I luckily get to do this every day as part of my job. My process includes production methods that simply wouldn't work for mass-market, commercially designed and produced products. I use hands-on processes, mixed media, from screen printing, to self-developed stamping, painting, and graphic processes. The result of my DIY approach to building instrument effects makes for a product with a more unique, less "factory" look...an appearance of being hand-built or crafted, which (hopefully) adds to the appeal and pride in ownership. Many are one-of-a-kind pedals, with brush-strokes. The circuits are more obscure and experimental (again, because of my DIY design approach), with extra wide range controls that don't often appear on commercial products.

How would your knowledge or design help you to create products in a better way?

My goal is to provide an alternative to mass-produced musical devices...a mix of unique art/appearance, and unusual but useful circuitry. Historically, many guitar pedals have had controls with "safe" ranges--they do one basic sound well, and most settings play nicely with each other. However, I have designed many pedals with extra wide ranges, where not all settings play nicely with each other. Yet, through this, players can also access more strange and inspiring sounds...hopefully something that increases creativity in their music.

DIY or buy and why? (This applies to the consumer and production of musical products)

I think both. I have built a guitar from blocks of wood (combined with some bought materials--paint, wound pickups, tuning mechanisms, knobs, potentiometers)...but I don't choose DIY every time I want a new guitar. Some guitars that I want are available--they're commercially available, and already have the features I want.

Most guitar pedals I use, I built and designed (out of my needs/wants, as there were no commercially available pedals that specifically fit my needs...sometimes, it might be that there are none that fit my needs *and* my budget.) But there are some pedal types/designs that are not my area of expertise, and I've bought those.

So "DIY or buy" depends on my needs, budget, free time, and ability. My musical needs and interests inspire my tendency to DIY...and my limitations in design/ resources/ability creates my need/want to sometimes buy.

Do you think diy culture is still in it's infancy in music?

I think DIY culture is something that *continues*. It changes in form (from books, correspondence, subcultures, groups of people practicing/participating in the same physical location, to ground practicing/participating through various internet forums), and may fluctuate in prevalence (in general, and within small subsets/niches), but I see it as the nature of humans. DIY culture is simply culture. It leads to commercial products, it can make commercial products better (by influencing the market / *what people want*, or by DIY ventures becomes business ventures. But simply by being human, we're required to practice some amount of DIY. And I think it's one of the most rewarding parts of being a human...those who rarely choose DIY are missing out!

How do you see the future for diy culture in music?

I may have answered this above...I think the DIY culture continues. It inspires and changes commercial products, and commercial products inspire and change DIY. Budgets, needs, musical trends, etc, all change the frequency of "DIY versus buy," but I don't think one ever overtakes the other.

Kassen is an artist who programs his own software solutions and uses customized software for a personalized selection of controllers to perform fascinating instant realtime music.

http://bottomfeeder.ca/top/



First instant reaction to the topic title.

A curiosity about the sense in which the words were used here.

Do you feel that current audio and music technology curriculum should include diy related classes? If so...why? And if you think it should be included, how can it help the field?

Well, in a way those classes inherently *are* DIY classes, in that the students are learning about making their own sounds and music, as opposed to acquiring the music of others. I suppose the question is more about making one's own tools and instruments. In that case; yes. A good look at the internal workings of tools will give a broader understanding of the principles involved than looking at just a single specific implementation. Even if the student wouldn't go on to create more tools and instruments that should help understand any given implementation and so future-proof his knowledge. I also feel that too much dependence on the ideas of others (in this case the vendors of commercial tools and instruments) isn't artistically healthy as it creates a dependence that need not be there. There is absolutely nothing wrong with picking ready made tools, but I would prefer it if those weren't the only option.

Given the opportunity to design, build or create a musical product, what would be your procedure and how would it be different or similar to a commercial designed and produced product?

First of all; I think the first occasion that the word "product" is used in here is a dangerous one; to me the word implies that it's aimed at a market, as opposed to at individuals. I'd rather talk about "instruments" or "tools" or "solutions", of course those might be for sale, but the economical perspective wouldn't come into play at this stage. Aside from that I think my designs are different in that I prefer specialized tools over generic ones, that with digital instruments I tend not to use a graphical interface at all and that I am more focussed at making virtuosic playing possible than at making the instruments accessible to new users.

How would your knowledge or design help you to create products in a better way?

I feel that DIY or small scale commercial operations have a better chance to make a instrument or tool that's highly suited to one particular question or task using a rapid update cycle and very close contact with the eventual user with less needs for compromises. Such designs might not be "better" in any universal sense, but they likely would be better for the specific context in which they'd be used.

DIY or buy and why? (This applies to the consumer and production of musical products)

It depends. DIY -to me- -and aside from experimenting for curiosity's sake- only makes practical sense when the designer has a idea that is significantly better than existing solutions for his or her particular case, or which is significantly cheaper. We should not forget that DIY is often time-consuming and that the individual designer lacks the means to produce in volume, something that keeps the cost of commercial products down. Generally I tend to buy and adapt controllers yet write software myself, hardware instruments I might modify instead of building a entirely new one.

Do you think diy culture is still in it’s infancy in music? Please comment.

No, not at all. I think DIY instruments are as old as music is, dating back to early bone-flutes and the like. What is new is the process of adapting industrially made objects to new purposes. In a way that is logical; we are still making instruments out of the things we find around us, our surroundings have merely changed. This does lead to new questions because -unlike wood, hide and bones- companies may object to this (as some creators of for example game consoles have done) or encourage this.
This does create new tensions and those are in their infancy. The attempt at showing or individuality that seems almost inherent in music might get a special sort of focus in a field where mass-fabricated instruments are more or less the norm. We could also say that the availability of cheap computers that allow for the usage of accessible programming languages put DIY software within the reach of many more people relatively recently.

However I would hesitate to say that that is fundamentally different to me from how other advances in technology over the centuries opened up more options for DIY instrument designers. The urge to self-expression seems a inherent part of human life and it is natural for people to try to adapt and shape the things around them to that end. Perhaps the thing that has changed is that first large companies gained the means to publish about their commercial instruments and relatively recently individuals gained the means to publish about their own inventions.
This might skew what we observe. It might also encourage more developments as individuals get in touch with each other to exchange ideas and point out options. I also feel that some forms of art that are intimately tied to technology are themselves new forms which might make DIY in those particular fields look especially new. Overall though I would say that it's the mass-fabricated and uniformed instruments that are really a new phenomenon, and not the DIY practice.

How do you see the future for diy culture in music?

I think there is a transition going on. As I see it we had/have a period where individual tinkerers have -apparently- had to reclaim some cultural ground that was lost to large companies. Fields like circuit-bending and plunder-phonics often sound like a sort of destructive rebellion against the uniformity of the mass market. I'm hoping that as we get more accustomed to our new surroundings a more constructive style will emerge that feels less need to comment on this uniformity by a sort of symbolic destruction and instead focusses on creating independent and more individual new things.

Any final words?

I think it might be worthwhile to also consider Open Source software as a scene where less individualistic DIY processes are going on, as well as scenes like the "demo" and the "livecoding" one where the DIY creation of works becomes (part of) the expression itself.

Michael Polane (sound) artist/designer. Under my moniker illiqual I do compositions whom are very towards DIY culture due to the fact that the sounds I use or design are made sounds from toys and improve. And I don't follow the "rules" of composition. So no song structures here I also do circuit-bending and graphically design stomp-boxes/synths.

http://soundcloud.com/illiqual



First instant reaction to the topic title.

Liberation.

Do you feel that current audio and music technology curriculum should include diy related classes? If so...why? And if you think it should be included, how can it help the field?

Yes! Because of the childlike approach of sound. It liberates the mind to think a certain way, the industrialized thought process overboard. It strips of layers what results in a direct electronic touch in thought and action.

Given the opportunity to design, build or create a musical product, what would be your procedure and how would it be different or similar to a commercial designed and produced product?

I would simplify my design, make it open/transparent and use existing schematics. And make it authentic , my own.

How would your knowledge or design help you to create products in a better way?

Don't know, less is more?

DIY or buy and why? (This applies to the consumer and production of musical products)

If you wish to be authentic DIY is an approach that works in my believe but the strongpoints of commercially designed products is the vastness of possibilities. So DIY with Beauty Buy

Do you think diy culture is still in it's infancy in music? Please comment.

No it is a style that has evolved into the current state due to internet and its behavioral infancy. But it was also the starting point of electronic music , DIY, so this is the next wave, the liberation.

How do you see the future for diy culture in music?

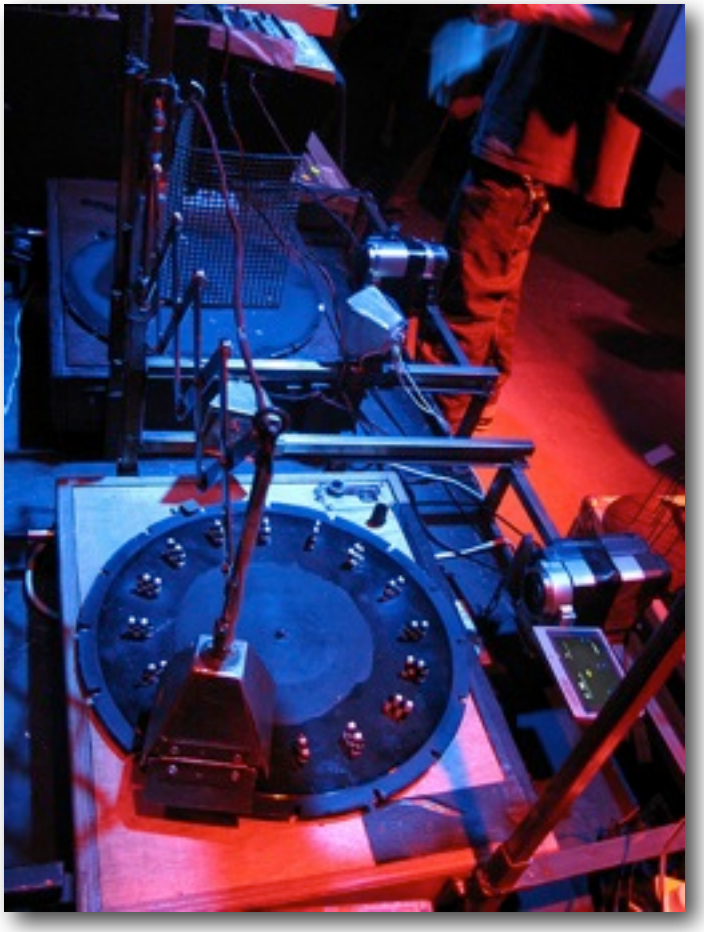
As a firmer player in the game

Any final words?

Authenticity makes audio slaves out of all of us.

My name is Maarten Halmans and I have little company that repairs, restores and designs electronic musical instruments and studio equipment. I also do audiovisual performances with a duo called Optical Machines. The audio is generated with partly self built electronic instruments. The visuals are generated with custom electronics and hardware.

http://www.opticalmachines.nl



First instant reaction to the topic title.

Buy when it is available, diy when you want something different. Electronic musical instruments today are developed with a commercial view and are often reproductions of gear developed in the past 40 years. Innovations in new commercial products are very limited. The diy community can change this and can make a positive contributions to the future of music technology.

Do you feel that current audio and music technology curriculum should include diy related classes? If so...why? And if you think it should be included, how can it help the field?

Yes, it should be included in the curriculum, it helps students to think outside the box and explore new grounds in electronic music. Big improvements can be made in musician specific interfaces and if the musician has an idea about the possibilities and limitations of electronics.

Given the opportunity to design, build or create a musical product, what would be your procedure and how would it be different or similar to a commercial designed and produced product?

I usually design for the needs of one musician, so the design is really specific. It is a process of many talks with the musician and often some prototypes to see if some ideas and concepts work or not. The final product is not optimized for mass production(both not in terms of used hardware, component costs and production costs)and often has a very open character for future adaptations and expansions.

How would your knowledge or design help you to create products in a better way?

I do custom projects for musicians and the starting point is not technology or the market but the needs of a musician. Musicians think in different way than the people who design electronics and commercial products. Because I am both an electronic engineer and a musician I can bridge the gap between technology and the needs of the musician.

DIY or buy and why? (This applies to the consumer and production of musical products)

Buy when it is available, there is no real need to build for example a 12 channel mixer when you can buy it. When it is not a specific instrument or tool it will only cost a lot of time and money to realize it. DIY gives the opportunity to do tailer made musical instruments.

Do you think diy culture is still in it’s infancy in music? Please comment.

No I don't think it is in it's infancy, prior to the internet diy was already pretty big but most people where not in contact with each other and a lot of devices and instruments were made but did not really evolve. At that time costs was also a big factor in diy. People built stuff themselves because it was much cheaper than commercial products and it gave the opportunity to make a instruments and musical tools that did exactly what the “designer” wanted and could be adapted to new needs. This changed when the price of consumer electronics dropped dramatically because of large scale integration and automated production of electronics. At that time the diy community became smaller, getting parts became harder and at the same time more and more people got in to computer generated music. Because of the internet diy got into a revival, it became easier to come in touch with other people with the same interests and it was easier to share ideas, projects, information and the access to specific parts became much easier than before.

How do you see the future for diy culture in music?

Diy will play a significant role in the next decade, most commercial companies did not really innovate in the last 20 years and most new instruments are based on the designs of about 40 years ago. The wishes of musicians become more diverse and commercial companies can not fulfill those needs. More small companies and individuals will play a role in the direction of electronic musical instruments and electronic music. Today it is also much easier to do small projects with a non commercial view and sell them thru internet.
But in the longer future it will become harder for a lot of people, thru hole technology(electronic components with leads) is becoming obsolete and and most electronic parts will be surface mount. This makes it harder to get started in diy because of the needed soldering skills. On the other hand it will become easier and cheaper to do small runs of specific semiconductors and electronic instruments.

My name is Jilt van Moorst. I make electronic music and live visuals for music performances, Besides that I'm a programmer, interaction designer and lecturer.

http://www.robotfunk.com



First instant reaction to the topic title.

It would be very limiting to only be able to use commercially available, ready made hard/software. Being able to create/mod your own tools instantly upgrades your craftsmanship and opens up a lot of possibilities. When I started doing live visuals in 1994 the available options were few and far between. None had the features I needed, especially the audio reactive and generally musically interesting ones. This was the main impetus for me to learn how to program, so I could make the tool I wanted to use. A few years later my creation is technologically outdated, but trying to use other commercially available software feels like being forced into a straightjacket designed by a person without anatomical knowledge.

Do you feel that current audio and music technology curriculum should include diy related classes? If so...why? And if you think it should be included, how can it help the field?

Depends somewhat on the level of the course, but I think it would add to the mind- and skill-set of students at any level. A lot of people feel that the field of music technology is maturing, and that the era of real innovation stopped decades ago. With the amount of options available commercially now you can get a lot of results (instantly) without having to design or build anything yourself. Perhaps we would see a lot more technological innovation if students learn to design and build their own instruments.

Given the opportunity to design, build or create a musical product, what would be your procedure and how would it be different or similar to a commercial designed and produced product?

I would probably not take the effort of designing and building something that is very similar to something that is already commercially available. When designing an instrument I would first try to define the need it would fulfill and then come up with a few possible approaches and test them, take the best one and improve it till it works, or abandon it if it doesn't. That said, some of the best ideas can come from simply tinkering, changing random things to see what happens. Some of the best creations create themselves.

How would your knowledge or design help you to create products in a better way?

Knowledge of design you mean? That seems rather obvious. Without knowledge you can't design and as you add knowledge you'd expect your designs to improve.

DIY or buy and why? (This applies to the consumer and production of musical products)

DIY when you want something that isn't available in the form you want it. DIY something that exists already if you are dedicated to learning the inner workings and principles. Or if you really really like solder fumes, debuggers and whatnot. Don't DIY to save money, you won't.

Do you think diy culture is still in it's infancy in music? Please comment.

I believe DIY culture is experiencing a bit of a renaissance at the moment after the perhaps more consumerist 80s and 90s. Especially the relatively new concept of open source soft- and hardware enables developers and tinkerers to share each others' efforts and save them from having to reinvent the wheel all the time. Also mobile- and microprocessors have become powerful enough for audio use which opens up a lot of possibilities. Then there's new affordable hardware out there like the Kinect that changes the game completely, allowing space itself to become an interface.

How do you see the future for diy culture in music?

DIY culture in general is booming, and not a day goes by without seeing a new innovative music instrument, be it an iPad app or an electronic device. It seems more and more people are getting involved so the future does look bright indeed.

Any final words?

Tinker on!

Damien Moody is an artist and musician who works with customized software and machines and is active in a number of new media formats and experimental ways of sharing his work.

http://audiodef.com/

I was fascinated when I read your thesis introduction. I hadn't thought of today's DIY potential in comparison to preindustrial culture. I look forward to reading the completed thesis. I think you've chosen a very good topic.

Audio and music technology curricula should definitely include courses on various aspect of DIY. For one thing, music is a about creativity, and a musician — regardless of his chosen instrument — who knows how to fix or build his own equipment will find his creativity enhanced by using tools he built or repaired himself.

Generally, I find increasingly fewer new musicians I like as I get older, and I think it's due in large part to modern capitalism and mass consumerism, which are antithetical to genuine creativity. It doesn't help that youngsters are presented with a vast array of what I consider crap to “appreciate” as “music”. It seems to me that a lot of young musicians and young people involved in the music business really want fame and money — they don't want to think and create something new. This is why I tend to discover new musicians in non-commercial venues like electro-music.com. It's places like these where people are more concerned with experimentation and creativity than with trying to sell something, and thus create genuinely interesting musical ideas. DIY by definition is opposed to capitalism and mass consumption, and encouraging DIY-think therefore encourages genuine creativity.

I probably would not have a set procedure. If I were going to build a musical product, I would figure out what parts I need and acquire them whenever/however I could. It could be radically different from anything commercial, or it could be quite similar to something commercial, different by minor criteria. It's hard for me to say. Most likely, it would be one or a small number of things I've been wanting to do but have been unable to find a commercial product that would do it the way I want, at a price I would consider reasonable. I'd get fed up at a certain point and start making plans to build it. I've already been doing this with food via organic gardening and composting my own food waste. It's just a matter of time before I get serious about building my own instruments.

I have had two Mackie Onyx mixers (the original series, not the i-series) for a few years and I'd been getting increasingly frustrated with Mackie's Windows device drivers. I had bought one, followed by a second a couple of years later when I'd learned that you could use two firewire-enabled Mackies in cooperation. I started having trouble with this immediately. It would work for a while, if I turned them on in a specific order. Then it would just not work as advertised unless I reinstalled the drivers on every boot.

It seems to me with the downward-spiraling economy and continuing financial rape of the masses by the already-wealthy and the government/corporate “elite”, an increasing return to that pre-war DIY mentality you mentioned would be logical, and that would apply to music as much as anything else. It's my hope that those of us who have the knack for building things will teach and encourage others to do the same.

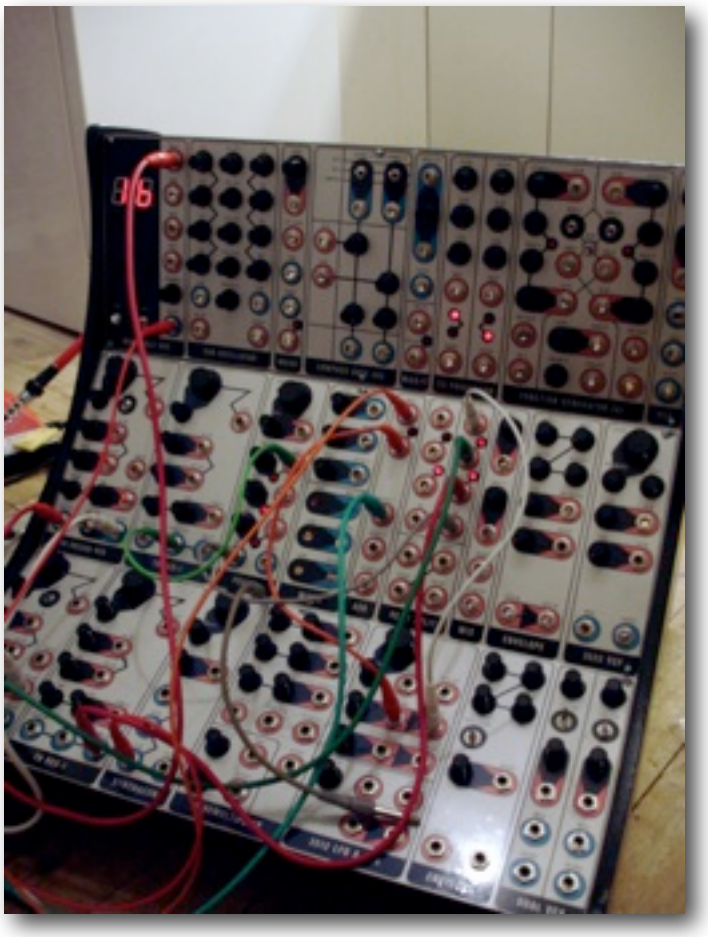
Since I've done this, I have not used Windows for music production, or really, anything serious. The sole Windows partition in my house only exists for games and isn't allowed to connect to the net.
Anyway, to answer this question directly, my experience with designing computer DAW systems resulted in, for me, a better DAW and better musical output. I have documented my experience in a Pro Audio for Gentoo how-to at http://audiodef.com/projects.php?project_id=1. Anyone who wants to can do this and I hope I have made it not only easier, but just plain easy.
Like with all things, whatever does the job. If I have more money but less time and the product exists to do what I need to, buy. If I have less money and more time (or simply less money), DIY. However, there are instances where the money does not matter at all. There's simply something intangible but concrete about using something you've put together yourself, be it pride in workmanship or a unique sound.
It seems to me that DIY in music is quite well established and growing. Just take a look at the DIY sections of electro-music.com. I only wish I knew as much as some of those dudes.

I don't remember how I found out, but I did learn that these mixers were supported by Linux's firewire FFADO drivers. Over the course of several months, I experimented with the Gentoo Linux operating system and eventually learned how to put together a smoothly functioning Gentoo-based DAW that ran both Mackies without any problems. In fact, I suspect I can hook up as many firewire Mackies as I want under Linux. Mackie, meanwhile, has discontinued support for chaining their Mackies. If I were them, I'd be flaming embarrassed. As a bonus, I have discovered software that I consider in sum to be much more flexible and powerful than integrated DAW software on Windows and MacOS. Linux audio production and music composition software is very modular — even fragmented — but I've found I can do a lot more once I let go of my ideas of “how it's supposed to be”. The whole experience has also taught me to understand both software and hardware on a deeper level, which naturally leads to more creative freedom.

My name is Jon Nensén, I'm 30 years old and I'm from Stockholm, Sweden. I'm currently working as a graphic designer, and have no formal education in electronics or music.

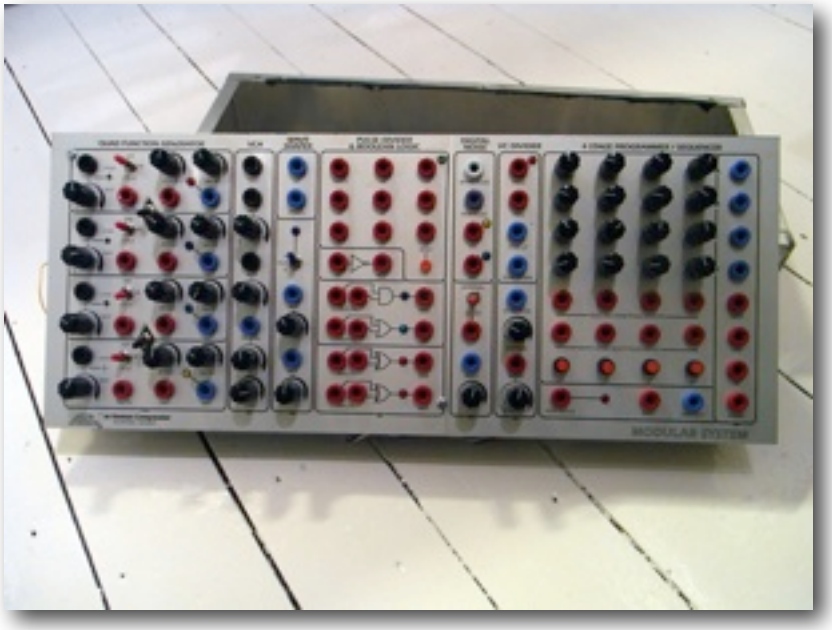
http://www.thehumancomparator.net/fs1a/

I started building synthesizers a few years back (2007?). The main reason I started building was because I figured it was cheaper than buying (Ha! What a fool I was). And because I thought everything looked ugly and I could make it better myself. The first things I built were no good. But after approx. 2 years I built this:



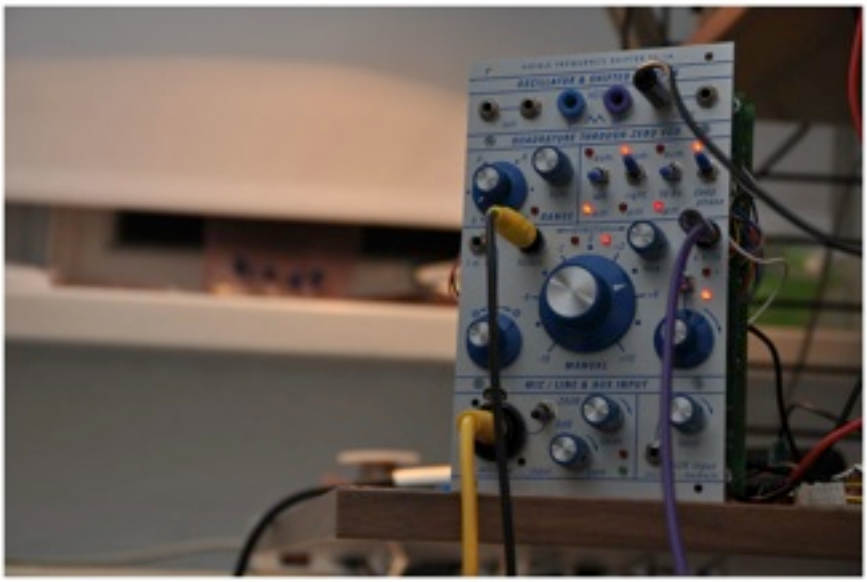
The more advanced my skills became, the more obscure and technical the building process got. And I think there's a tendency to wander away from the commercial products, since there is no fun in building stuff that is easily available.

I got interested in circuits from a designer called Ken Stone, http://cgs.synth.net/ CGS (Cat Girl Synth). Which is designed and inspired around a synth designer called Serge Tcherepnin, AKA Serge. My first designs in this area was building "clones" made to resemble the original Serge modulars. Serge modules and CGS modules are esoteric and have almost "elusive" functions...



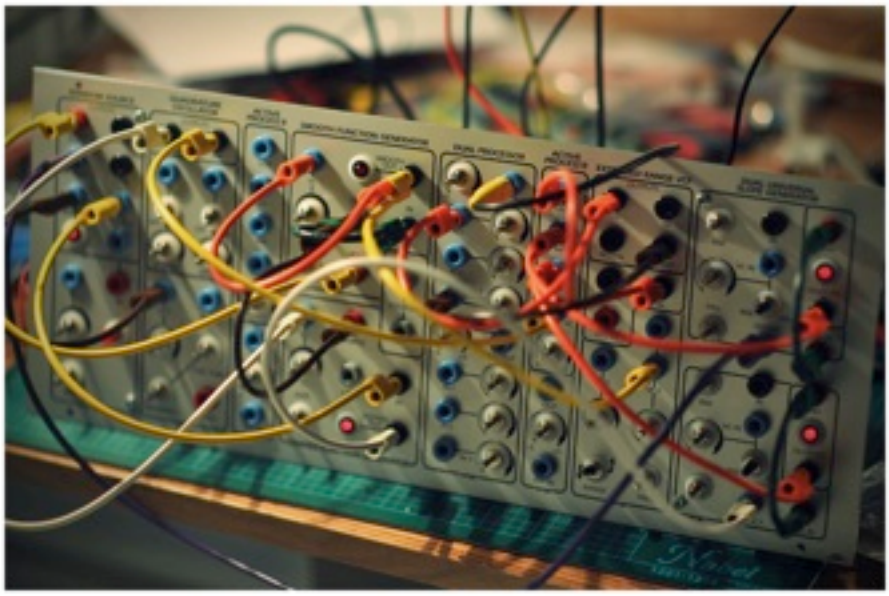
The more involved I've gotten into building synthesizers, I figured I wanted to give something back to the community. The place where most people fall short is the designing the front panel, and then having the knowledge to produce it. So I realized that I could offer panels for the people who wanted to buy and build these systems. So I made a sketch, posted it on line and asked for people if there was interest in having panels like this produced. I've got positive replies and made some panels. And this has continued, though I've outsourced the handling of production to people who are more savvy at it. I just draw, send them a file and people get panels. I get no money for this. Though I sometimes get free panels.

I do occasional rounds of other panels, inspired by other manufacturers. This is one I did half a year or so ago. It's a frequency shifter from Jürgen Haible (www.jhaible.de) with a Buchla (www.buchla.com) style front panel I designed.



I offered a simple parts page for that build: http://www.thehumancomparator.net/fs1a/ Where people buying the panels could find the basic things they needed. I hope to do more Buchla style panels in the future.

But to recap: By this time the focus had shifted for me when I started out I was more interested in the "music", i.e. in actually making songs, verse-refrain-bridge and so on. By building these big systems I became more interested in sound. What kind of sound does this kind of build do? What kind of noise can I generate? How does a transistor sound?



This is my latest build. It's still missing knobs. Which I have to custom order from the company who made the knobs to Serge systems years ago. Since I've grown more and more anal during my building process - I'm now replicating the old Serge systems from the 80's. Down to a really low level. Which most people would think is just unnecessary.

First instant reaction to the topic title.

First reaction was actually like "finally!". DIY culture is coming on to the radar and it's a huge movement. And the more people who get into it, the faster it will grow. And the more people will understand that it is not as hard as you might think.

Do you feel that current audio and music technology curriculum should include diy related classes? If so...why? And if you think it should be included, how can it help the field?

Yes, I actually do think so. Current classes may include MAX/MSP and Supercollider? Which is sort of DIY though software? Or at least exploring different synthesis and sound design by making your own programs (circuits?). I think the problem with DIY in the case of actually building stuff comes in different forms of barriers. If you have a class in circuitry, then people will learn how, for example, a filter works. But they haven't learned how to make an interface for it that makes it "playable". For me using an instrument is 2 parts how it sounds and how it feels. And if you're having classes in DIY - you need to teach both. OR be able to supply one or the other. I think that's a big thresh hold in the DIY community, you're either good at designing circuits or designing interfaces. (I'd like to see independent test on if the same circuitry sounds different depending on the actually panel it's placed behind. I'm sure that a good looking synth sounds "better" then a ugly one - the visual and tactile input is as important as the sound. But I've gotten a bit carried away). To teach people how to design an instrument is a very big field. Which would make it a very fun thing to explore. At the same time a very complex area. Though this is what DIY is for me, constructing a product as a whole.

Given the opportunity to design, build or create a musical product, what would be your procedure and how would it be different or similar to a commercial designed and produced product?

Since I build very specific systems, which are clones. My procedure isn't that different from when they were producing the units back in the 80's. Though the way I put together the systems, the selection of modules have changed quite a bit since I started. At first I was more into a single module, thinking about how it would sound, what I could do with it. Also wanting to add as much as possible to the module to get everything I could out of it. Now I more see things as a whole. Willing to sacrifice different functions in one module, for others in another module. Thinking about the chain, not the individual building blocks. Not feature creeping my builds so much.

It has also changed the way I see commercial products. As I have a more critical eye to it. And also question the usability and conformity of the industry. There's a lot of synthesizers out there that follows the same old molds that the synthesizers did in the 70's. This also comes to interface designs. Newness is usually seen on small independent manufacturers. who tend to go belly up after a too short time on the market. Or be too expensive for anyone who isn't crazy about the idea.

How would your knowledge or design help you to create products in a better way?

The question is a bit unclear for me. My guess it's about how I use my knowledge to actually build better stuff? For me being a graphic designer I have a big advantage when it comes down to making the actual presentation of the product. And the more I build the better I become of understanding functions and my own needs.

DIY or buy and why? (This applies to the consumer and production of musical products)

I think this is like apples or pears. Some things you can DIY, some you can't. Somethings you can buy, some you can't. If you'd like a huge 8 voice synthesizer with all the bells and whistles, you can build it. But it will cost as much, or even more then actually buying one! And if you'd like patch memory and things like that, then there will be a fair amount of R&D to develop functions like that.

But if you're looking for controller surfaces which can fit your needs, then they can be done more extreme and probably cheaper then getting a new one. Though DIY are seldom cheap.

Though I haven't bought musical equipment for over a year. Before I started DIY I probably should and bought synthesizers several times a year. Looking for that perfect instrument which could help me realize my musical needs. Now I just build them. And frown on newly released products...

Do you think diy culture is still in it's infancy in music? Please comment.

This kinda depends on which direction you're coming from - If I look towards the old geeks, who did music concrete stuff in the 70's who worked big modular systems they built themselves, and got boards from Electronotes. They've been around for ever. Also the system I clone, Serge, started out as a DIY system back in the 70's. On the other hand, you have all these young people, coming from trackers, reason and so on. Getting interested in hardware, building APC's, MFOS boards and other crap things, looking for an analogue sound. (Might also have a Doepfer modular at home, or wanting one). They are new, and they're the big part of the new DIY revolution. Which also internet has contributed to. In my eyes. I'm probably wrong though, and there's more aspects of this. (I feel like I want to write more about this; computers in music vs. analog gear and the benefits of actually owning and touching the things you play. But I guess that's a different story).

How do you see the future for diy culture in music?

I think it will continue to grow. The more people get interested and see how easy it actually is the more will follow. And the more people into it, the more circuits and designs will be available. And so it will continue to grow..

Any final words?

I don't know. I hope I got some of the questions right at least :)

Pehr Meldert is a DIY-er, he circuit bends, builds his own synthesizers, records and performs with them. He has a very extensive blog with a lot of useful links and information on his work and things related to diy sound design.

http://loxodrom.blogspot.com/



First instant reaction to the topic title.

Pretty good title. It makes me curious, because of the 'future' part of this thesis (most of my diy is old school diy).

Do you feel that current audio and music technology curriculum should include diy related classes? If so...why? And if you think it should be included, how can it help the field?

Yes, I think that there should be the possibility. Musical students who are interested in technology/craftmanship should be able to combine a degree as musician/engineer, if they like. Perhaps that will be good for the development of musical instruments in the future. Otherwise, it could just be fun to combine different kinds of courses for the students.

Given the opportunity to design, build or create a musical product, what would be your procedure and how would it be different or similar to a commercial designed and produced product?

I would look at the demand on different web forums. Create a product with development help from these communities. It would be a different product for sure, because I don't want to create yet-another...something. I have lots of ideas with synthesizer modules for example, where I probably would use programmable electronics to create something new/different.

How would your knowledge or design help you to create products in a better way?

It's not my knowledge or design, it's my creativity, to think outside the box.

DIY or buy and why? (This applies to the consumer and production of musical products)

DIY is a hobby by itself, so to build and play are almost to different hobbies. So if you're interested and have time to build, then DIY. If you'd rather just play and don't have much time for building, then buy.

Do you think diy culture is still in it's infancy in music? Please comment.

Old school diy and analog electronics, no. Digital electronics diy, yes. Digital programmable electronics has become huge with arduino for example. It's cheap and fun :)

How do you see the future for diy culture in music?

It will probably influence the big instrument manufacturer somehow, by demand of a new product invented with diy or if a diy-er becomes an employee of a big instrument manufacturer.