Beyond a Skeuomorphic Representation of Subtractive Synthesis

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ABSTRACT
This proposition paper wants to raise the issue of design ideology within the field of music software that recreates vintage analogue synthesizers using subtractive synthesis. There is a clear dominance of a skeuomorphic design ideology regarding the Graphical User Interface (GUI) within this field. The suggested study aims to research if this is a correct choice in terms us usability, accessibility and intuitiveness. The suggestion is to conduct a series of A/B tests of custom prototype UIs on three predefined groups of users. Group A, with a previous knowledge of analogue hardware synthesizers, Group B, with a knowledge of music software but limited experience with analogue hardware synthesizers and finally Group C, with a limited knowledge and experience of both music software and analogue hardware synthesizers. The prototype GUIs will be made using a skeuomorphic design paradigm as well as a flat design paradigm that also incorporates a couple of new ideas in terms of input controls. The A/B tests will be complemented with semi-structured interviews with the participants.

Author Keywords
Software synthesizers; subtractive synthesis; music software; graphical user interface; graphic design; skeuomorphism; flat design.

ACM Classification Keywords
H.5.2. Information interfaces and presentation (e.g., HCI): User Interfaces; H.5.5. Information interfaces and presentation (e.g., HCI): Sound and Music Computing.

INTRODUCTION

Apple, in large part influenced by Steve Jobs, brought the skeuomorphic design ideology to the large digital audiences in the early 21th century. The style has lost a little bit of ground every year since then. Today most web pages and many mobile and desktop applications has abandoned the realistic style for a more clean and simplified look, often referred to as flat design. A development accelerated by the demands of responsive web design. There is however one area within Graphical User Interface (GUI) design where the skeuomorphic design view still thrives and that is digital software versions of vintage music gear. This study will specifically focus on digital software versions of vintage synthesizers that use the classic subtractive synthesis.

French company Arturia has for instance recreated classic synthesizers like the Arp 2600, Prophet 5 and Roland Jupiter 8 keeping every rotary knob, patch cable and wooden detail in the synthesizers digital incarnations.

While this makes sense from a nostalgic standpoint this study aims to find out if it also makes sense from a usability and accessibility standpoint. One argument for this is that users who are acquainted with the original hardware immediately know their way around the software.

Or is it a good idea to incorporate flat design philosophy and also new kinds of input controls in the world of subtractive synthesis software synthesizers the same way it has now come to dominate web design?

Figure 1. Arturia Prophet-V2.
Example of Skeuomorphic design recreating the classic Prophet 5 synthesizer, produced by Sequential Circuits 1978-1984.

There exist some examples of flat design within GUI design for software synthesizers. The Floppytron Synth from Sampleso [13] is one such example. Another interesting example, especially concerning the visual cues found in the input controls (e.g. value visualized by colors filling the up the actual control) is the Aalto Semi-Modular Software Synthesizer from Madrona Labs [8].

MILC '18, March 11, Tokyo, Japan.

Figure 2. LFO-controls in The Floppytron Synth. Example of flat design GUI for software synthesizers.

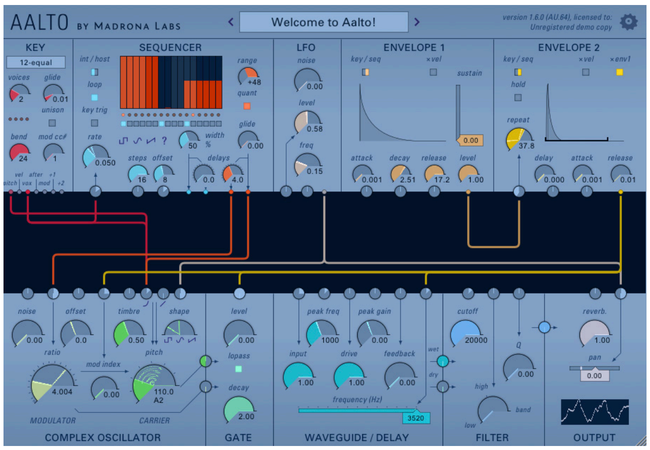

Figure 3. Aalto Semi-Modular Software Synthesizer.

There is no doubt though that when recreating classic subtractive synthesis in the computer, the realistic approach is far more common in terms of the GUI.

DEFINING CONCEPTS

The study will be centered around three key concepts. And although skeuomorphism and flat design might be public knowledge by now there is a need to define how they will be used in this particular study. For readers not well acquainted with subtractive synthesis, this is defined as well. Both regarding physical hardware and in the digital format that will be used and tested in the study.

Skeuomorphism

Oxford Living Dictionaries defines *skeuomorph* [10] as "an object or feature which imitates the design of a similar artefact made from another material", and for computing in particular as "an element of a graphical user interface which mimics a physical object". The graphic designer accomplishes this by using tints and shadows, perspectives and textures imitating physical objects. The idea is to make the interface easier to use for people already familiar with the objects that are pictured.

Flat design

The general idea concerning flat design is that it is simpler, more streamlined and lacks the perspectives, textures and lighting effects found in skeuomorphism. Flat design approaches the concept of stylization and functional minimalism. Focus is ease of use, scalability and fast download speed/minimal use of the Graphics Processing Unit (GPU). Tuner (2014) describes flat design as removing stylistic characters such as drop shadows, gradients, textures, and any other type of design that is meant to make the element feel three-dimensional [15]. It's worth pointing out though that flat design can still keep skeuomorphic elements in the sense that it uses visual metaphors for real life objects. It just doesn't aim for a realistic graphic style.

Subtractive Synthesis

Subtractive synthesis is a method to produce an audio signal found in early hardware synthesizers of the 1960s and 70s. It is still used in a majority of modern analogue synthesizers as well, and often recreated digitally in software synthesizers [6]. The audio signal/sound that is generated is attenuated by a filter, subtracting frequencies and altering the timbre. In essence, the sound will usually have three main elements present: the sound generator (usually an oscillator), the filter (to shape the tone) and the envelope (to control the volume over time) [3]. In addition to this most analogue synthesizers also include a Low-frequency Oscillator which produces pulse for modulation of the audio signal. There is generally also a Voltage-controlled amplifier to amplify the audio signal.

PREVIOUS STUDIES

There exist several studies on skeuomorphism vs. flat design [2], [11], [12], and there has been an ongoing debate concerning especially Apple's former fondness for the skeuomorphic philosophy for a couple of years [1]. To my knowledge though, no one has yet focused on software versions of classic subtractive synthesis in regards to this aspect of the GUI.

METHOD

The study will be conducted through a series of A/B tests on users from three clearly defined groups of users. The members of the groups will be observed as they solve given tasks using prototype software synthesizers with custom GUIs. One prototype will be designed in a skeuomorphic style with visual metaphors reminiscent of vintage hardware synthesizers and another will be done with a flat design GUI replacing the rotary knobs with new kinds of interactivity (described under the section "Designing the Prototypes"). Eventual differences in workflow between the prototypes is of particular interest. After the A/B test the participants will be interviewed using a semi-structured interview format. The questions will be of qualitative nature and the participants will be asked to explain why a certain workflow where chosen or preferred. The aim is to answer questions regarding usability, intuitiveness, accessibility and general User Experience (UX). There will be focus on differences between the three groups of users as well as experiences of individual users regardless of group affiliation. Pure aesthetic preferences will also be of interest.

THE USER GROUPS

These are the three groups of users that will participate in the study:

Group A: Previous experience of both music software and analogue hardware using subtractive synthesis

This group of users will consist of persons that has knowledge and experience of music software and also previous experience with analogue hardware. This group would appear to be a key target audience for skeuomorphic software synthesizers since they are the ones who would benefit most from the software resembling vintage hardware. As an interesting paradox though, there exist at least one study [14] suggesting they are sometimes convinced non-users of software synthesizers, believing they lack the quality of the original hardware.

Group B: Previous experience of music software, limited experience of analogue hardware

In this group, the users are familiar with music software and producing music in general. They are however not experienced in vintage or modern analogue synthesizer hardware, and their experience with subtractive synthesis should be very limited. Ideal participants would be musicians working outside the field of electronic music.

Group C: Limited experience of both music software and analogue hardware

This group will be made up of beginners in the realms of music production and synthesizers. They have to have a fair amount of computer literacy but no previous or limited contact with music software or analogue hardware synthesizer.

DESIGNING THE PROTOTYPES

The software synthesizer prototypes for the study will be built using Native Instruments Reaktor 6, a modular Digital Signal Processing (DSP) lab [9]. The prototypes will recreate a classic subtractive synthesis-signal path using two Voltage-controlled Oscillators (VCOs), one highpass/lowpass filter (VCF), one Low-frequency Oscillator (LFO), an Envelop Generator (EG) and a Voltage-controlled Amplifier (VCA).

For clarity, the traditional names using VC as a prefix is used, even though a digital version of subtractive synthesis isn't technically voltage controlled.

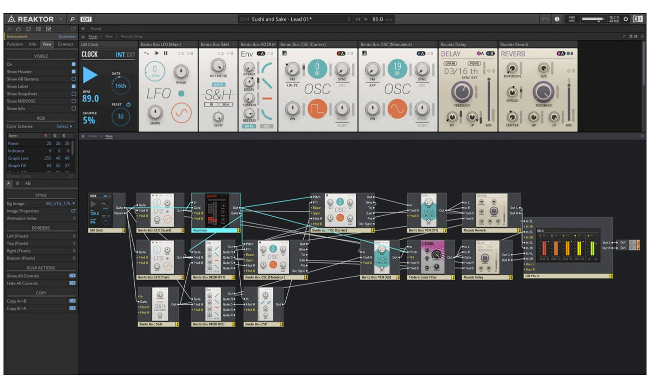

Figure 4.
Building prototypes in Native Instruments Reaktor 6.

The components of the prototypes will be layered with custom skins designed in Adobe Illustrator.

Prototype 1 (P1) will be made in a traditional skeuomorphic design drawing inspiration from classic vintage hardware synthesizers like the Minimoog Model D and Korg Mono/Poly. The majority of the input controls will be made up of digitally recreated rotary knobs. The design will incorporate 3D perspective, artificial lighting resulting in tints and shadows and textures recreating wood, metal and plastic details. Since the purpose of the study primarily is to investigate different visual design paradigms, the general layout will be based on the very traditional oscillators > filter > envelope generator workflow. A layout presumably recognized by the participants in Group A. If initial tests prove confusing to this group, to use an actual digital recreation of for example the Minimoog Model D might be an option.

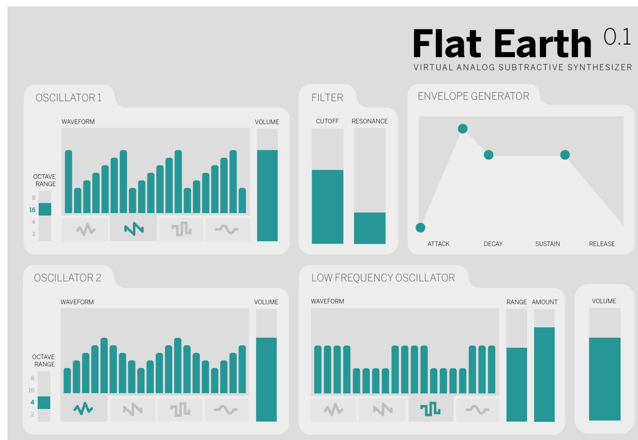

Figure 5. Initial sketch of Prototype 2.

Prototype 2 (P2) will be designed using a minimalistic flat design ideology with clear solid colours. In addition to this some changes will be done in terms of input controls. It will however keep the layout of components and elements found in P1, making the visual paradigm and the input controls the key differences between the two prototypes. One of the skeuomorphic design choices the study aims to challenge is the digitally recreated rotary knob. Virtual rotary knobs present a physical challenge for linear input devices like the computer mouse or the trackpad which aren't naturally built for rotation. However, some interfaces apply a hidden linear input which lets the user drag up or down vertically to change the value. In P2 this vertical linear input will get visual signifiers in the form of sliders/meters that fills up showing the value of the specific functions.

Presented here are some suggestions for changes in terms of input controls for the specific components of the subtractive synthesis signal-path. An initial sketch of Prototype 2 can also be seen in Figure 5. There are good arguments for the graphic designer to also take interest in the technical aspects of the software [5]. Taking this into account, the design and layout may change if technical aspects, especially related to the actual synthesizer build in Reaktor 6, deems it necessary.

Voltage-controlled Oscillators (VCOs)
The key feature for the oscillators is the choice of waveforms. Traditionally this is done with a rotary knob. For the flat design prototype this will be changed to illuminating buttons giving more space to showcase images of the waveforms. The selected waveform will light up when chosen. Choice of octave range will be done with a slider instead of a rotary knob.

Voltage-controlled Filter (VCF)
Taking in account interesting technical studies [4], [7] regarding the relation between oscillators and filters, the VCF of the flat design version will get a placement with a close proximity to the oscillators. If it checks out well in initial testing, the VCF controls might even be included in the same component box as the VCOs. The traditional rotary knob will be avoided here as well, exchanged for a more visually clear representation of value. A suggestion is to use two vertical meters that fills up with the amount of Cutoff and Resonance applied to the signal.

Low-frequency Oscillator (LFO)
For the LFO the visual representation would be the same as for the VCO, adding an extra slider for the frequency control. Illuminated buttons to choose the waveform. It would also be interesting with an actual visual display on how the LFO modulates the signal path.

Envelope Generator (EG)
For the control of the Attack Decay Sustain Release (ADSR) EG there already exists some good examples of visual representation of the sound. The four stages of the EG can easily be converted to node points that the user can affect directly inside the actual visualization. This takes away the need for rotary knobs in the EG component as well.

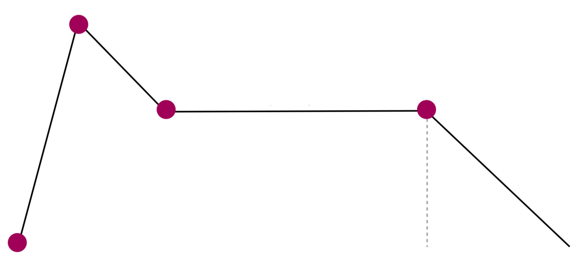

Figure 6.
Example of how every stage of the EG (ADSR) can be converted to controllable node points.

Voltage-controlled Amplifier (VCA)
You could argue that for a simple subtractive software synthesizer the controls for the VCA could be dropped altogether. To get good alignment with the skeuomorphic design though, controls for gain and output will be included in the flat design as well, but converted to horizontal sliders reminiscent of what you would find in an ordinary digital music player.

Controllers
While using the prototypes an external MIDI keyboard will be used to control the pitch/key. There will however be no other forms of external physical controllers, for instance for rotary knobs. Everything else in the synthesizers User Interface (UI) will be controlled using a standard computer mouse.

CONCLUSIONS TO BE MADE
The study aims to find some evidence as to whether the dominating skeuomorphic paradigm in designing software synthesizers has merit outside of the obvious nostalgic connotations. Does the resemblance to classic hardware have the suggested positive effect on usability, accessibility and general user experience? How well does the argument hold up that if the user already knows how to use the hardware, they will know how to use the software as well. And how does this affect users who actually hasn't that kind of previous knowledge? It's also interesting to find out how the different groups of users respond to changes in the design of interface and input controls. What kind of difference in preferences can be found? Which group of users responds best to taking a flat design approach.

In terms of visualizing the audio signal and testing new input controls there are also much that can be done by extending the study to include more ideas and prototypes. One interesting continuation of the study would also be to try and find new visual representation of more complex modular synthesizers with far more components using a variety of different input controls.

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